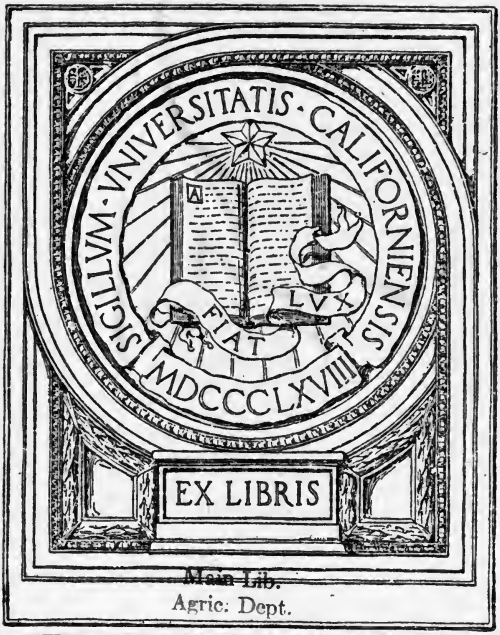

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H. W. WILEY, Chief of Bureau.

IDENTIFICATION OF FOOD COLORS.

A TENTATIVE REPORT ON THE SOLUBILITY AND EXTRACTION OF CERTAIN COLORS, AND THE COLOR REACTIONS OF DYED FIBER AND OF AQUEOUS AND SULPHURIC ACID SOLUTIONS.

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INTRODUCTION.

The subject of food colors is so extensive, and so little comparatively has been accomplished in this field, that the reports made have been of necessity of a tentative nature, such for example as the work reported by W. G. Berry, in Circular 25 of this Bureau, in 1905, under the title "Coloring Matters for Food Stuffs and Methods for their Detection." That work, presented by the referee on colors in the Association of Official Agricultural Chemists, was supplemented by a subreport by Mr. Loomis in 1906, issued as Circular 35. This circular has proved of assistance to those doing pioneer work along these lines, having been reprinted in 1908 and 1909 with slight changes. The data presented in the present revision have been modified and extended in accordance with the results of more recent investigations, and an analytical scheme for the preliminary identification of colors added. The difficulties of this subject and the variations in the colors used preclude any marked degree of finality in such results, but the data are thought to be of special interest and usefulness to food chemists at this time.

Respectfully,

H. W. Wiley,
Chief of Bureau.

Approved:

James Wilson,
Secretary of Agriculture.

Washington, D. C., *September 10, 1910.*

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PLAN OF THE EXPERIMENTS.

The tables given in this report show the result of experimental work done on various coloring matters. Most of the coal-tar colors used were obtained direct from the manufacturers or agents, to whom acknowledgment is due. The names of these firms and the abbreviations under which they are designated in the descriptions of the colors in the tables are as follows:

H. A. Metz & Co., agents for Meister, Lucius & Brüning (M. L. B.).
Berlin Aniline Works (Berlin).
American Aniline and Extract Company, agents for Brooke, Simpson & Spiller, Ltd., London, E. (B. S. S.).
Continental Color and Chemical Company, agents for F. Bayer & Co. (By.) and Badische Anilin- und Soda-Fabrik (Bad.).
Cassella Color Company (Cassella).
Geisenheimer & Co., agents for K. Oehler (Oehler).
Read, Holliday & Sons (R. H.).
Schoellkopf, Hartford & Hanna Company (Sch.).
W. F. Sykes & Co., agents for St. Denis Dye Stuff and Chemical Company (St. Denis), and for Coez, Langlois & Company (Coez) or (Sykes).
Kalle & Co. (Kalle).
Eimer & Amend (E. & A.).
George Grübler & Co. (Grübler).

The revision of Tables I to IV consists chiefly in a rearrangement of the data and a consecutive numbering of the colors in a manner which permits of ready reference from one table to another and renders the information more readily accessible. While these tables do not by any means include all food colors, the greater part of those usually employed will be found. A thorough examination has been made of the colors used in this investigation and some important corrections have been made. The tables have also been extended somewhat and an analytical scheme for the preliminary identification of colors has been added (see page 62).

As has been pointed out by several workers on this subject, any scheme for the identification of colors in foodstuffs and allied substances is necessarily subject to constant revision on account of the vast number of colors, both natural and synthetic, which are already on the market, and the number of which is constantly being increased. However, in the author's experience, the number of colors used for that purpose commercially is quite limited, as the matter of cost and availability excludes many of the natural colors and the nature of each food product excludes dyes other than those of a certain color or chemical nature.

It is very essential for the identification of a coal-tar color, or any other coloring matter in foods, to obtain the color in as pure a state as possible. All colors used in the preparation of these tables were

supplied as pure colors, but tests have also been made to ascertain if they were mixtures of more than one color. This was found to be the case in a few instances.

SOLUBILITY.

The results given for solubility in Table I are only approximate and were obtained by shaking an excess of the color with the various solvents named, filtering, if necessary, and evaporating to dryness, in order to determine the amount of color dissolved. The letters used to express the varying degrees of solubility are explained in connection with the table. Where the color of the solution is not given, it may be assumed to be practically the same as that of the aqueous solution.

The numbers in the last column of Table I are those of the corresponding colors in Green's translation of the fourth German edition of "A Systematic Survey of the Organic Coloring Matters," by Schultz and Julius.

EXTRACTION WITH IMMISCIBLE SOLVENTS.

The determinations given in Table II were made as follows:

Twenty-five cubic centimeters of a 0.01 per cent solution of coal tar color, or about 0.10 per cent solution of natural coloring matters, were well shaken up with 25 cc of the immiscible solvent in a separating funnel. In the case of extraction with acetone the solution of color was first saturated with common salt to render the acetone insoluble. After separation into layers, the amount of color extracted was determined either by the relative depth of color in the two layers or by taking equal volumes of each layer and ascertaining the proportions by dyeing tests on plain or mordanted wool. The signs 0, $>\frac{1}{2}$ (more than half), and $<\frac{1}{2}$ (less than half) indicate the amount of color extracted from the aqueous solution. The color given underneath the above signs indicates the color of the immiscible solvent solution, unless otherwise specified. From 5 to 10 drops of concentrated hydrochloric acid or ammonium hydroxid (0.95 sp. gr.) were used to make the solutions acid or alkaline.

COLOR REACTIONS OF DYED FIBER.

In the tests reported in Table III the wool was dyed with one-half per cent of coal-tar color in every case; in the case of natural coloring matters the amount used was about ten times greater. A piece of dyed zephyr yarn about 1 inch long was covered with 2 or 3 cc of the reagent in a small porcelain dish. Unless the color of the reagent became marked nothing is noted in the column marked "solution" in the table. The color reactions were observed three or four minutes after the addition of the reagent. The dyed fiber should be dry in making these tests to prevent charring of the fiber by the strong acids.

REACTION OF COLORS IN AQUEOUS SOLUTION AND WITH CONCENTRATED SULPHURIC ACID.

While similar tables have been prepared by other workers, considerable uncertainty arises in using them, and it has been the aim of the writer in preparing these tables to be somewhat more precise in the description of these reactions. As one means to this end, in Table IV the approximate strength of the color solution used (about 0.01 per cent) is indicated by the color of the solution in a test tube three-quarters of an inch in diameter. As before stated, the solutions of natural coloring matter are about ten times stronger than those of the coal-tar dyes, namely, 0.1 and 0.01 per cent, respectively. About 5 cc of color solution, 0.2 gram of zinc dust, and 10 drops of concentrated hydrochloric acid were used for the reduction test, and approximately 10 cc of color solution for the other reactions in aqueous solution.

The dry color test with concentrated sulphuric acid was conducted as follows:

About 0.01 gram of coal-tar color, or 0.05 gram of natural coloring matter, was dissolved by shaking with 5 cc of concentrated sulphuric acid in a test tube. The solution was diluted with water, 3 to 5 cc at a time, until the volume reached about 20 cc, then more rapidly with constant shaking, noting any changes in the appearance of the solution, until such change seemed merely to affect the depth of the color.

DISCUSSION OF DETAILS OF MANÍPULATION.

Precautions to be observed in applying the Sostegni and Carpentieri method.

In the case of coal-tar dyes the well-known method of Sostegni and Carpentieri[a] is adapted:

If the color is in aqueous solution, slightly acid with hydrochloric acid, the wool can be heated in it directly or after diluting.

If in alcoholic solution the alcohol should first be driven off by evaporation.

If in a solid or semisolid substance, the color can generally be extracted by wool after dissolving or suspending the finely divided substance in water and slightly acidifying with hydrochloric acid.

In some cases, however, it is better to extract the finely divided and dried substance by warming with alcohol or water, made slightly alkaline with ammonia. The alcohol is then evaporated off, keeping up the volume with water, the aqueous solution is made slightly acid with hydrochloric acid and the color extracted by wool.

For heavy saccharine substances, such as confectionery, it is often best to evaporate as far as possible on the steam bath and then

[a] U. S. Dept. Agr., Bureau of Chemistry Bul. 107, revised, p. 190

extract the color from the residue with strong alcohol; or the sugar may be wholly or in part removed by diluting and fermenting with yeast. In cereal products and in other cases, possibly, it is a good plan to make a preliminary extraction with ether. This removes interfering fat or oil and indicates the presence or absence of oil-soluble color.

The color is dyed on a piece of white zephyr yarn or nun's veiling, freed from dirt and grease by boiling with very dilute sodium hydroxid (0.1 per cent), in a solution slightly acid with hydrochloric acid. The wool is removed, well washed, and the color extracted therefrom by warming in very dilute ammonia. In most cases fifteen minutes' gentle boiling is sufficient. The wool is then removed, its color noted, and the solution made slightly acid with hydrochloric acid and the dyeing and extraction process repeated on a new piece of wool.

If the second piece of wool, after extracting the coal-tar color a second time with ammonium hydroxid as far as possible, is clean and shows no indication of the presence of vegetable color on the fiber, the alkaline solution of coal-tar color is sufficiently pure. Otherwise the process of dyeing and extraction must be repeated on a new piece of wool till the absence of vegetable color is indicated.

The color solution is then evaporated to dryness on the water bath, when there is obtained a residue of the dry color, on part of which the reaction with concentrated sulphuric acid may be tried and from which a neutral aqueous solution may be prepared for extraction and color tests.

This procedure applies only to acid coal-tar dyes; similarly, by reversing the process—that is, dyeing in neutral or slightly alkaline solution, and extracting the color from the fiber by a solution weakly acid with hydrochloric acid—basic coal-tar dyes can be isolated in a state of reasonable purity for identification. The solution of color may also be investigated by the spectroscope.[a]

EXAMINATION OF OILS AND FATS.

(1) Carry out the process for determination of unsaponifiable organic matter, and test for colors in the unsaponifiable matter.

(2) In case the oil or melted fat shows positive reaction by Geisler's fuller's earth test,[b] continue by treating 50 grams or more of the oil with 25 grams of fuller's earth, and after standing one hour, with frequent shaking, filter, wash earth free from oil with gasoline, and

[a] Formánek, Untersuchung und Nachweis organischer Farbstoffe auf spektroscopischem Wege.

[b] Zts. Nahr. Genussm., 1899. *2*:150.

then extract color from fuller's earth with hot alcohol, and apply tests for identifying the color.

(3) Shake gasoline solution of colored oil or fat with very weak potassium hydroxid solution (Leed's method).

(4) Shake the oil or melted fat with boiling 90 per cent alcohol for several minutes. Cool with ice about one hour, then filter through a filter wet with alcohol. Reduce the volume of the alcohol solution about one-third on the water bath and decant or filter from any oil which separates on cooling. The color may be separated from this oil by the method under (1). Color tests may now be applied to the alcoholic solution of the color or to the dry color obtained by its evaporation. This alcoholic solution would, of course, also contain any free fatty acids, cholesterol, or phytosterol in the oil or fat.

DETECTION OF MIXED COLORS.

(1) Macroscopic or microscopic examination of dry color.

(2) One of the best ways for testing mechanically mixed, dry colors is by sprinkling the powdered color on the surface of sulphuric acid in a broad shallow dish, such as a petri culture dish, and noticing any difference in the colored spots formed. A similar method with water is commonly used, and it is recommended that this test be carried out as follows:

Fill a 500 cc Griffin beaker to the depth of about 4 inches with water, or in some cases preferably with dilute alcohol. On the surface sprinkle the powdered color. The streaks of color formed in the liquid as the particles fall to the bottom of the beaker will generally indicate plainly whether one or more colors are present.

(3) Capillarity test. (Allen, Commercial Organic Analysis, vol. 3, pt. 1, p. 478.)

(4) Fractional dyeing. (Allen, loc. cit., p. 479.)

(5) Treatment of dry color with various solvents, or extraction of aqueous solution with immiscible solvents, and making comparative dyeing tests with extracted color and residual color in aqueous solution.

NATURAL COLORING MATTERS.

It is generally very difficult to isolate natural coloring matters in a state of purity, and the task of identifying them with certainty is still more complicated. They can best be separated by extraction with an immiscible solvent, or by dyeing on wool, mordanted with alum, tin, or chromium. Special tests have also been devised for the more common natural coloring matters, which can be found in any standard work on food analysis. Caramel is extensively used as a coloring matter in food products, and its detection is important, especially in vanilla extracts and liquors. In case of a brown-colored

substance, which gives no reaction for acid or basic coal-tar dye, tests should always be made for caramel. It is best not to depend on any one procedure but to apply several of the many suggested for this purpose. The following have been found most useful:

Marsh's test as modified by Tolman, depending on the insolubility of caramel color in amyl alcohol. (Bul. 122, Bureau of Chemistry, p. 206.)

The fuller's earth test is very useful as a supplementary test, but it is first necessary for the analyst to experiment with the particular lot of fuller's earth used. For instance, in the case of vanilla extracts preliminary experiments should be made with known samples of pure extracts and samples colored wholly or partly with caramel.

Phenylhydrazine test (for extracts). (Bul. 65, Bureau of Chemistry, p. 71.)

Paraldehyde test (for distilled liquors). (Bul. 107, Bureau of Chemistry, p. 101.)

To detect mineral pigments or to identify color lakes, it is necessary to examine the incinerated substance for heavy metals, chiefly aluminum, tin, and iron.

METHODS OF MORDANTING WOOL.

Mordanting wool with alum.—In 500 cc of water dissolve 1 gram of crystallized aluminum sulphate and 1.2 grams of cream of tartar. Stir 10 grams of fat-free wool in the solution for one-half hour, let stand two to three hours, wring and dry at room temperature.

Mordanting wool with tin.—In 500 cc of water dissolve 0.8 gram of tin crystals, and 0.4 grams of oxalic acid. Boil 10 grams of fat-free wool one and one-half hours in this solution.

Mordanting wool with bichromate of potash.—Place 10 grams of wool in 500 cc of water and heat to boiling, then add 0.2 gram of potassium bichromate, 0.35 gram of cream of tartar, and 0.1 cc of concentrated sulphuric acid, and boil one and one-half hours. Dry at low temperature and keep mordanted wool from exposure to light.

TABLE I.—SOLUBILITY OF COLORS, WITH COLOR OF SOLUTION.

[S = readily soluble; s = fairly soluble; F = slightly soluble; f = almost insoluble; I = insoluble.]

COAL-TAR COLORS.

No.	Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
1	Ponceau red (Grübler).	S Crimson.	F Orange.	S Orange.	I	f	I	F	S Red orange.	.....	.....
2	Ponceau 6 R (M. L. B.).	S Crimson.	I	S Deep cherry.	I	I	I	I	I	.....	108
3	Scarlet 6 R (M. L. B.).	S Cherry red.	I	S Crimson.	I	I	I	I	I	.....	108
4	New coccin (Berlin).	S Orange red.	F Cherry.	S Cherry.	I	f Orange.	I	I	f	.....	106
5	Cochineal red A (Bad.).	S Orange red.	s	S Cherry red.	I	f Reddish.	F	f Pink.	F Orange red.	.....	106
6	Ponceau 4 RB (Berlin).	S Crimson.	S	S	I	f Pink.	F	F	S	.....	160
7	Croceïn scarlet 3 B (By.).	S Cherry.	S	S Red orange.	I	I	F	F	s Red orange; ppt.	.....	160
8	Croceïn scarlet 7 B (By.).	S Crimson.	S	S Deep cherry.	I	I	F	F Magenta.	s Orange red.	.....	169
9	Fast ponceau B (Bad.).	S Orange red.	s Red orange.	S	I	I	F Red orange.	F Pale magenta.	F Brown.	.....	163

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
10	Biebrich fast scarlet O (Kalle).	S Orange red.	F Orange.	S Scarlet.	I	F Orange.	f Pink.	f Pink.	s Wine red.	.....	159
11	Biebrich croceïn scarlet O (Kalle).	s Orange red.	F Orange red.	S Scarlet.	I	f Orange.	f Orange.	f Pink.	F Crimson.	.....	160
12	Biebrich croceïn scarlet OO (Kalle).	S Scarlet.	F Scarlet.	F Scarlet.	I	f Orange.	F Orange.	f Pink.	F Crimson.	.....	169
13	Biebrich brilliant croceïn scarlet O (Kalle).	S Scarlet.	F Orange red.	S Scarlet.	I	f Orange.	f Orange.	f Orange.	F Scarlet.	.....	146
14	Biebrich brilliant croceïn scarlet ON (Kalle).	s Scarlet.	F Orange red.	s Scarlet.	I	f Orange.	f Orange.	f Orange.	F Scarlet.	.....	146
15	Scarlet RD (R. H.). (Mixture.)	S Orange red.	s	S	I	F	F	F	S	.....	.....
16	Ponceau 2 R (Sch.).	S Cherry red.	F	S	I	I	I	I	F Orange red.	.....	55
17	Ponceau 3 R (Sch.).	S Cherry red.	F	S	I	I	I	I	F	.....	56
18	Brilliant cochineal 2 R (Cassella).	S Orange red.	S	S	I	I	f Orange.	F	S	.....	53

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
19	Fast red A (Bad.).	S Orange red.	S	S	I	s	s	S	S Crimson.	.....	102
20	Fast red B (Bad.).	S Deep crimson.	S Deep orange red.	S Crimson.	I	f Orange.	s Orange red.	f Pink.	S Crimson.	.....	65
21	Bordeaux B (Berlin).	S Crimson.	s Crimson.	S	I	I	I	F	S	.....	65
22	Fast red C (Bad.).	S Crimson.	S Orange red.	S Orange red.	I	f Pink.	f Orange red.	F Magenta.	s Crimson.	.....	103
23	Azo-rubin (Sch.).	S Crimson.	F	s	I	I	f Pale magenta.	f Pale magenta.	F Cherry.	.....	103
24	Carmosin B (R. H.).	S Crimson.	F	S	I	f Red orange.	F Brown orange.	F	F	.....	103
25	Fast red D (Bad.).	S Crimson.	S	S	I	s Orange red.	s Orange red.	s Orange red.	S Crimson.	.....	.....
26	Amaranth B (Cassella). (Mixture.)	S Deep crimson.	f Pink.	f Wine color.	I	I	I	I	f Orange brown.	.....	.....
27	Amaranth (Sch.).	S Crimson.	I	S	I	I	I	I	f Pink.	.....	107

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
28	Archil substitute (R. H.).	f Red orange.	s	s Crimson.	I	F	F Crimson.	F	s	.....	28
29	Archil substitute 3 VN (St. Denis).	S Magenta.	s Crimson.	S Crimson.	F Orange red.	F Crimson.	S Crimson.	F Crimson.	F Wine red.	.....	29
30	Lanafuchsin 6 B (Cassella).	S Deep crimson.	S	S	I	I	F	F Purple.	S	.....	.....
31	Magenta.	S Crimson.	S	S	F Lilac.	s Crimson.	s	S	S	.....	448
32	Acid magenta (Bad.).	S Deep crimson.	S	S	I	I	F Violet.	f Pale magenta.	f Pale magenta.	.....	462
33	Safranin (B. S. S.).	S Crimson.	S Cherry; fluor.	S Cherry; slight fluor.	I	F	F Cherry; fluor.	S Cherry; fluor.	S	.....	584
34	Benzopurpurin (Grübler).	s Cherry red.	S Cherry.	S	I	f Orange.	F	f	I	.....	277 or 278
35	Congo red (Grübler).	S Cherry red.	s	S Deep orange.	I	I	I	I	I	.....	240
36	Eosin (Grübler). (Mixture.)	S Cherry red; fluor.	S Red orange; strong fluor.	S Red orange; strong fluor.	I	F Red orange; fluor.	F Red orange; fluor.	S Red orange; fluor.	S Yellow.	.....	.....

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
37	Eosin A (Bad.).	S Orange red; green fluor.	S Orange; green fluor.	S Orange; green fluor.	I	F Pink; green fluor.	F Green fluor.	S Green fluor.	S Orange.	.....	512
38	Azo-eosin (By.).	S Scarlet.	S Orange red.	S Orange red.	I	F Orange red.	f Scarlet.	S Orange red; green fluor.	F Orange red.	.....	71
39	Phloxin (Bad.).	S Orange; green fluor.	S Orange red; yellow fluor.	S Orange; green fluor.	f Pink.	S Pink; yellow fluor.	S Yellow fluor.	S Pink; yellow fluor.	S Orange.	.....	521 and 518
40	Rose bengal (Bad.).	S Orange red.	S Light crimson.	S Light crimson.	f Pink.	s Light crimson; yellow fluor.	s Light crimson; yellow fluor.	S Crimson.	s Orange.	.....	520 and 523
41	Rhodamin (Bad.).	S Light crimson.	S Deep pink; yellow fluor.	S Deep pink; yellow fluor.	F Light magenta.	S Slight fluor.	S Yellow fluor.	S Yellow fluor.	S Deep pink; yellow fluor.	.....	504
42	Pink M (R. H.).	S Light crimson; fluor.	S	S	F Pale magenta.	S Cherry; fluor.	S Cherry; fluor.	S Cherry; fluor.	S Cherry; fluor.	.....	504
43	Fast pink B (Sch.).	S Cherry red; yellow fluor.	S Yellow fluor.	S Fluor.	F Fluor.	S Fluor.	s Fluor.	S Fluor.	S Fluor.	.....	504
44	Erythrosin (certified).	S Orange red.	s Red orange; slight greenish fluor.	Same as ethyl alcohol.	I	s Red orange; strong orange fluor.	Same as ethyl acetate.	s Red orange.	F Yellow.	S Orange red.	517

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
45	Tropæolin O (Cassella).	S Orange.	F	F	I	f Yellow.	F	F	s	.....	84
46	Tropæolin OO (Cassella).	S Orange.	S	S	I	F	f Orange yellow.	F	S Wine red.	.....	88
47	Orange IV (R. H.).	F Orange.	S	S	f Yellow.	s Orange yellow.	F	s	F Orange brown.	.....	88
48	Methyl orange (Grübler).	S Orange.	S	S	I	F	F Yellow.	F	f Light brown.	.....	87
49	Orange extra (Cassella).	S Red orange.	s Orange red.	F	I	f Orange.	F	F	s	.....	86
50	Orange II (St. Denis).	S Orange red.	s Orange.	S Orange.	I	F Orange.	F Orange.	F Orange.	s Orange.	.....	86(?)
51	Orange II (By.).	S Red orange.	F	S	I	f	f Orange.	F	F	.....	86
52	Tyemond orange (R. H.) (Mixture).	S Orange brown.	F Orange.	S Red.	I	f	F Orange.	f Orange.	s Red orange.	.....	.....
53	Croceïn orange Y (Sch.).	S Orange.	F	S	I	f	F	F	F	.....	43
54	Orange I (certified).	S Red orange.	s Orange.	s Orange.	f	s	F	F	S	S Crimson.	85

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
55	Croceïn orange G (By.).	S Orange.	S	S	f	F	F	F	F	.....	13
56	Ponceau 4 GB (Berlin).	S Orange red.	S Orange yellow.	F Orange yellow.	I	F Orange.	F	f Orange yellow.	s	.....	13
57	Orange G (Berlin).	S Orange.	F Orange yellow.	F	I	I	f	I	S	.....	14
58	Orange G (R. H.).	S Red orange.	s Orange red.	s	I	f Orange.	F	F	s	.....	86
59	Orange GG crystals (Cassella).	S Orange.	F	S	I	f Yellow.	f	I	S	.....	14
60	Auramine.	S Yellow.	S	S	I	S	S	S	S	.....	425 or 426
61	Naphthol yellow (Bad.).	S Yellow.	F	S	I	f	F	f	f	.....	4
62	Yellow YM (R. H.).	S Orange.	F Yellow.	S	f	f	F	f	s Yellow.	.....	4
63	Naphthol yellow (Grübler).	F Yellow.	S	S	s or F Yellow.	S	S	S	s	.....	.....
64	Martius yellow.	F Yellow.	S	S	S	S	S	S	s Pale yellow.	S	3
65	Picric acid.	F Yellow.	S	S	S	S	S	f	S Pale yellow.	s	1
66	Chrysamin.	F Orange yellow.	F	s Orange.	I	f	F	I	f	s Orange red.	220 or 269

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
67	Fast yellow (Bad.).	S Orange yellow.	F Yellow.	S	f	F	f Yellow.	f Yellow.	F Orange red.	.....	8
68	Wool yellow T extra (Sch.).	S Yellow.	F	s	I	I	I	I	f	.....	94
69	Tartrazin (Bad.).	S Yellow.	F	F	I	I	I	I	f	.....	94
70	Metanil yellow (Oehler).	S Orange	S Yellow.	S Orange.	F Yellow.	S	F Yellow.	S Yellow.	S Orange brown.	.....	95
71	Brilliant yellow S (Sch.).	S Brown.	f Yellow.	S Brown.	I	I	I	I	F Yellow.	.....	89
72	"Chinolin yellow" (R. H.).[a]	S Yellow.	F Yellow.	S	I	F	F	F	F	.....	667 (?)
73	Chrysoïdin (Grübler).	S Orange red.	S	S	f Yellow.	s	F Orange brown.	S	S	.....	18 (?)
74	Sudan I (prepared by author).	I	S Orange.	S Orange.	S	S	S	S	S Red orange.	.....	11
75	Sudan brown (Berlin).	I	S Brown.	S	S Red brown.	S	S	S Yellow brown.	S Red brown.	.....	59
76	Sudan G (prepared by author).	f Yellow.	S Orange red.	S Orange red.	S	S	S	S	S Orange red.	.....	10

[a] Manufacturer's term; undoubtedly same as "quinolin."

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
77	Malachite green (Berlin).	S Greenish blue.	S	S	f Pale blue.	s	S	F Bluish green.	S	.....	427
78	Ethyl green (Berlin).	S Bluish green.	S	S	I	F	S	F Bluish green.	S	.....	.....
78½	Sudan III (prepared by author).	I	s Red orange.	s	S Orange red.	S	S	s Red orange.	S Orange red.	.....	143
79	Acid green 780 (Cassella).	S Green.	S	S	I	I	f	F	F	.....	435
80	Acid green OO (Sch.).	S Blue green.	s	S	I	I	I	I	F	.....	435
81	Cyanole green 6 G (Cassella).	S Bluish green.	S Blue.	S Blue.	I	f	S	S Blue.	S	.....	.....
82	Naphthol green B (Cassella).	S Green.	f	S	I	I	I	I	I	.....	398
83	Azo blue (By.).	S Deep violet.	F Magenta.	F Crimson.	I	f Pink.	F Crimson.	f	F Magenta.	.....	257
84	Cyanole FF (Cassella).	S Deep purple.	S	S	I	f Blue.	F	F Blue.	S	.....	439

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
85	Methylene blue (Bad.).	S Deep blue.	S	S	I	f	F	F	S	.....	650
86	Tetracyanole SF (Cassella).	S Blue.	S	S	I	F	F	F	S	.....	440
87	Methyl-violet DB (Sch.).	S Violet.	S	S	F Violet.	S	S	S	S	.....	451
88	Methylene violet 2 BX (Berlin).	S Deep violet.	S	S	f Violet.	s	S	S	S	.....	585
89	Indigo disulpho acid (certified).	S Dark blue.	F Blue.	S Dark blue.	I	I	I	I	S Violet blue.	S Dark green.	692
90	Bismarck brown extra (Berlin).	S Orange brown.	S	S	I	F Brown.	f Yellow.	F Brown.	f Brown yellow.	.....	197
91	Fast brown G (Berlin).	S Crimson.	S	S	I	F Orange brown.	f	I	F	.....	138

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
92	Naphthol black BDF (Cassella).	S Violet blue.	I	S	I	I	I	I	I	.....	188
93	Naphthol blue black (Cassella).	S Dark blue.	S	S	I	F Purple.	F Blue violet.	f Pale blue.	S	S	.....
				NATURAL COLORS.							
94	Cochineal.	S Wine red.	S	F	I	I	I	I	S Orange.	S Purple.	706
95	Cudbear (E. & A.).	F Violet red.	F Crimson.	S Crimson.	f	s Crimson.	F Crimson.	F Crimson.	S Crimson.	S Purple.	.....
96	Archil (E. & A.).	s Wine red.	S	S Crimson.	I	F	F	F	F Red.	S Crimson.	710
97	Litmus cubes.	S Blue.	I	I	I	I	I	I	I	S Blue.	.....
98	Azo-litmin (Merck).	S Magenta.	I	I	I	I	I	I	F Orange red.	S Blue.	.....
99	Indigo, Bengal	I	I	I	I	I	I	I	F Blue.	I	689

TABLE I.—*Solubility of colors, with color of solution*—Continued.

NATURAL COLORS—Continued.

No.	Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
100	Alcannin, oil soluble (German).	I	S Crimson.	S	S	S	S	S	S Orange red.	S Blue.	.....
101	Coloring matter, logwood (E. & A.).	F Brown.	S	S	F Orange.	S	S	S	S	S Red brown.	702
102	Coloring matter, Brazil wood (E. & A.).	f Orange yellow.	s Orange.	S Orange brown.	F Yellow.	S Orange.	S Orange brown.	S Orange brown.	S Orange brown.	S Wine red.	701
103	Coloring matter, barwood (E. & A.).	I	S Wine red.	S Wine red.	F Yellow.	S Orange brown.	S Orange brown.	S Wine red.	S Orange red.	S Maroon.	705
104	Catechu (E. & A.).	f (s, hot water.)	I	F Orange yellow.	I	I	I	I	I	S Brown.	703
105	Yellow color from American safflower.	S Yellow.	f Pale yellow.	F Yellow.	I	I	I	I	F	S Yellow brown.	.....
106	Spanish saffron (E. & A.).	S Orange.	F Yellow.	S Orange.	f	F	F	I	S	S	.....
107	Cape aloes (E. & A.).	S Yellow brown.	S Yellow brown.	S	F Yellow.	F Yellow.	S	F	S	S Orange brown.	.....

TABLE I.—*Solubility of colors, with color of solution*—Continued.

NATURAL COLORS—Continued.

No.	Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
108	Coloring matter, quercitron (E. & A.).	F Yellow.	s Yellow brown.	s Yellow brown.	f	F	s Yellow brown.	f	F	s Brown.	699
109	Sumac powder (E. & A.).	S Yellow brown.	I	F	I	I	f	I	S	S Yellow brown.	.....
110	Annatto (E. & A.).	I	F Orange.	F	s	S	F	F	s	f Orange.	709
111	Turmeric.	I	S Orange.	s	F	s	F	F	S	F Orange brown.	707
112	Persian berry extract (Sykes).	S Yellow.	F Yellow.	F	I	I	I	f	F	S Red brown.	700
113	Fustic extract, excelsior (Sykes).	S Yellow brown.	S	s	S Yellow.	s	S	s	S	S Brown.	698
114	Weld extract (Sykes).	F Yellow.	f Yellow.	F Yellow.	I	I	I	I	F Brown yellow.	S Yellow brown.	696
115	Chlorophyl, fat soluble (Germany).	I	S	S	S	S	S	S	S Green.	S Green.	.....
116	Buckthorn berries (Germany, E. & A.).	S Yellow brown.	F Yellow.	S Yellow brown.	I	f Yellow.	I	I	s	S Brown.	700

TABLE II.—EXTRACTION OF COLORS WITH IMMISCIBLE SOLVENTS FROM AQUEOUS SOLUTIONS.

[Fraction indicates amount of color extracted by one treatment; P = color precipitated from solution by salt.]

COAL-TAR COLORS.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
1	Ponceau red (Grübler).	0	0	0	$<\frac{1}{2}$ Orange.	$<\frac{1}{2}$ Yellow pink.	$<\frac{1}{2}$ Orange.	P$<\frac{1}{2}$ Orange yellow.	$<\frac{1}{2}$ Orange.	$\frac{1}{2}$
2	Ponceau 6 R (M. L. B.).	0	0	0	0	0	0	0	0	0
3	Scarlet 6 R (M. L. B.).	0	0	0	0	0	0	0	0	0
4	New coccin (Berlin).	0	0	0	0	0	Nearly 0 Pink.	Nearly 0 Orange.	Nearly 0 Pink.	Nearly 0 Orange.
5	Cochineal red A (Bad.).	0	0	0	0	0	$\frac{1}{2}$ Orange red.	0	0	$\frac{1}{2}$
6	Ponceau 4 R B (Berlin).	0	0	0	$<\frac{1}{2}$	$<\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
7	Croceïn scarlet 3 B (By.).	0	0	0	$<\frac{1}{2}$ Pink.	$<\frac{1}{2}$ Yellow pink.	$\frac{1}{2}$ Pink.	$\frac{1}{2}$ Orange.	$\frac{1}{2}$	$\frac{1}{2}$
8	Croceïn scarlet 7 B (By.).	0	0	0	0	0	All extracted.	$\frac{1}{2}$	$\frac{1}{2}$	$>\frac{1}{2}$
9	Fast ponceau B (Bad.).	0	0	Nearly 0 Pink.	$<\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$ Orange red.	$\frac{1}{2}$	$\frac{1}{2}$

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline	Acid.	Neutral.	Alkaline.	Acid.
10	Biebrich fast scarlet O (Kalle).	0	0	Nearly 0	Nearly 0 Orange pink.	Nearly 0 Orange pink.	All extracted. Scarlet.	<½	½	½
11	Biebrich croceïn scarlet O (Kalle).	0	0	0	Nearly 0 Pink.	Nearly 0 Pink.	All extracted. Scarlet.	½ Red orange.	½ Red orange.	>½ Red orange.
12	Biebrich croceïn scarlet OO (Kalle).	0	0	Nearly 0	Nearly 0	Nearly 0	All extracted. Scarlet.	½	½	½ Red orange.
13	Biebrich brilliant croceïn scarlet O (Kalle).	0	0	0	<½ Orange pink.	<½	All extracted. Scarlet.	½	½	>½
14	Biebrich brilliant croceïn scarlet ON (Kalle).	0	0	<½ Orange.	Nearly 0	Nearly 0	Nearly all extracted. Red orange.	½	<½	>½ Red orange.
15	Scarlet RD (R. H.). (Mixture.)	0	0	<½ Orange.	½	½ Orange.	Nearly all extracted. Orange.	½	½ Orange.	½
16	Ponceau 2 R (Sch.).	0	0	0	Nearly 0	0	>½ Orange red; H_2O solution, pink.	Nearly 0 H_2O solution, orange.	Nearly 0 H_2O solution, orange.	½ Orange.
17	Ponceau 3 R (Sch.).	0	0	0	<½ H_2O solution, orange red.	0 H_2O solution, orange red.	½ Orange.	<½ Yellow pink; H_2O solution, orange red.	Nearly 0 Yellow pink.	<½ Orange.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
18	Brilliant cochineal 2 R (Cassella).	0	0	0 Yellowish.	Nearly 0	Nearly 0	½ Orange.	½ Orange.	½	½
19	Fast red A (Bad.).	0	Nearly 0 Yellow pink.	Nearly all extracted. Cherry red.	Nearly all extracted.	Nearly all extracted.	Nearly all extracted.	P>½	½	>½
20	Fast red B (Bad.).	0	0	Nearly 0 Pinkish.	<½ Pink.	Nearly 0	½ Orange red.	P ½ Orange red.	<½	½
21	Bordeaux B (Berlin).	0	0	0	<½	<½	<½	<½	P<½	½
22	Fast red C (Bad.).	0	0	Nearly 0 Pink.	<½ Pink.	Nearly 0	>½	½ Orange red.	Nearly 0	>½
23	Azo rubin (Sch.).	0	0	0	½	Nearly 0 H_2O solution, scarlet.	All extracted. Scarlet.	½ Pink orange.	Nearly 0	½
24	Carmosin B (R. H.)	0	0	Nearly 0 Pink.	½	Nearly 0 Pink.	All extracted.	½	Nearly 0 Orange.	½ Scarlet.
25	Fast red D (Bad.).	<½	<½	>½ Orange red.	<½	½	All extracted. Scarlet.	P>½	½	½
26	Amaranth B (Cassella). (Mixture.)	0	0	0	0	0	0	0	0 H_2O purple.	0

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
27	Amaranth (Sch.).	0	0	0	0	0	Nearly 0	0	0	0
28	Archil substitute (R. H.).	0	Nearly 0 Pink.	Nearly 0 Violet ppt. in H_2O solution.	Nearly all extracted.	$>\frac{1}{2}$ Scarlet.	All extracted.	Nearly all extracted.	Nearly all extracted.	$>\frac{1}{2}$ Crimson.
29	Archil substitute 3 VN (St. Denis).	$<\frac{1}{2}$ Lilac; H_2O solution, crimson.	$<\frac{1}{2}$ Lilac; H_2O solution, crimson.	$\frac{1}{2}$ Red orange; H_2O solution, purple.	$>\frac{1}{2}$ Crimson.	$>\frac{1}{2}$ Magenta.	Nearly all extracted. Crimson.	$>\frac{1}{2}$	Nearly all extracted. Crimson.	$>\frac{1}{2}$ Crimson.
30	Lanafuchsin 6 B (Cassella).	0	0	0	Nearly 0	0	$\frac{1}{2}$	$\frac{1}{2}$	Nearly 0	$>\frac{1}{2}$
31	Magenta.	$<\frac{1}{2}$ Purple.	$\frac{1}{2}$	$<\frac{1}{2}$ Magenta.	$\frac{1}{2}$ Crimson.	All extracted.	All extracted.	$>\frac{1}{2}$ Crimson.	$>\frac{1}{2}$	$>\frac{1}{2}$
32	Acid magenta (Bad.).	0	0	0	0	0	0	0	0	0
33	Safranin (B. S. S.).	0	0	$<\frac{1}{2}$ Pink.	$>\frac{1}{2}$	All extracted.	All extracted.	$>\frac{1}{2}$ Orange red.	$>\frac{1}{2}$ Orange red.	$>\frac{1}{2}$ Orange red.
34	Benzopurpurin (Grübler).	0	0	0	$<\frac{1}{2}$ Orange red.	$<\frac{1}{2}$ Orange red.	$<\frac{1}{2}$	Nearly all extracted.	Nearly all extracted.	Nearly all extracted.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
35	Congo red (Grübler).	0	0	0 H_2O blue.	Nearly 0	$<\frac{1}{2}$	0 H_2O blue.	$>\frac{1}{2}$	$>\frac{1}{2}$	$<\frac{1}{2}$ Pink; H_2O blue.
36	Eosin (Grübler)(mixture).	$>\frac{1}{2}$ Yellow.	$<\frac{1}{2}$ Pink.	$>\frac{1}{2}$ Pink.	$>\frac{1}{2}$ Pink.	$\frac{1}{2}$	$>\frac{1}{2}$ Yellow.	$>\frac{1}{2}$ Orange pink.	$\frac{1}{2}$	All extracted. Yellow.
37	Eosin A (Bad.).	$\frac{1}{2}$	$\frac{1}{2}$	$>\frac{1}{2}$	$>\frac{1}{2}$	$\frac{1}{2}$	$>\frac{1}{2}$	$>\frac{1}{2}$	$\frac{1}{2}$	$>\frac{1}{2}$
38	Azo-eosin (By.).	$<\frac{1}{2}$ Pink.	$<\frac{1}{2}$ Pink.	$\frac{1}{2}$ Orange.	$\frac{1}{2}$ Orange.	$\frac{1}{2}$	$>\frac{1}{2}$	P$>\frac{1}{2}$ Yellow pink.	$\frac{1}{2}$	$>\frac{1}{2}$ Red orange.
39	Phloxin (Bad.).	$\frac{1}{2}$ Yellow fluor.	$\frac{1}{2}$	$>\frac{1}{2}$ Yellow.	$\frac{1}{2}$ Pink, no fluor.	$\frac{1}{2}$	$>\frac{1}{2}$ Yellow.	$\frac{1}{2}$ Orange fluor.	$\frac{1}{2}$	Nearly all extracted. Yellow.
40	Rose bengal (Bad.).	0	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$>\frac{1}{2}$	$>\frac{1}{2}$ Orange red.	$>\frac{1}{2}$	All extracted. Orange yellow.
41	Rhodamin (Bad.).	$<\frac{1}{2}$ Yellow fluor.	$<\frac{1}{2}$	$\frac{1}{2}$ Fluor.	All extracted. Orange fluor.	All extracted. Fluor.	All extracted. Fluor.	$>\frac{1}{2}$ Fluor.	$>\frac{1}{2}$ Fluor.	$>\frac{1}{2}$ Fluor.
42	Pink M (R. H.).	$>\frac{1}{2}$ Nearly colorless.	$>\frac{1}{2}$ Colorless.	$\frac{1}{2}$	All extracted. Yellow fluor.	All extracted. Yellow fluor.	All extracted. Yellow fluor.	$>\frac{1}{2}$ Fluor.	$\frac{1}{2}$ Fluor.	$>\frac{1}{2}$ Fluor.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
43	Fast pink B (Sch.).	Nearly all extracted. Colorless.	Nearly all extracted. Colorless.	½ Pink.	All extracted. Yellow fluor.	All extracted. Yellow fluor.	All extracted. Yellow fluor.	½ Yellow fluor.	½ Fluor.	½ Fluor.
44	Erythrosin.	Nearly all extracted. Orange fluor; H_2O pink.	Nearly 0	All extracted. Orange.	½ Deep pink; H_2O red orange.	<½ Pink; H_2O red orange.	All extracted. Red orange.	>½ Fluor.	½ Red orange fluor; H_2O red orange.	All extracted. Orange.
45	Tropæolin O (Cassella).	0	0	<½	<½ Yellow; H_2O solution, orange.	0	Nearly all extracted. Orange.	½	<½	>½
46	Tropæolin OO (Cassella).	<½	<½	½ Yellow.	>½	>½	All extracted.	>½	Nearly all extracted.	>½
47	Orange IV (R. H.).	<½ Yellow.	½ Yellow; H_2O solution, orange.	½ Yellow; H_2O solution, crimson.	½	½	Nearly all extracted. Orange red; H_2O solution, pink.	Nearly all extracted.	Nearly all extracted. Orange.	Nearly all extracted. Red orange.
48	Methyl orange.	0	Nearly 0	0	<½	<½	½	½	½	½
49	Orange extra (Cassella).	0	0	½	All extracted.	½	All extracted.	>½	½	>½

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
50	Orange II (St. Denis).	Nearly 0	Nearly 0	½	½	<½	All extracted. Orange.	>½	½	>½
51	Orange II (By.).	0	0	½	½	½	All extracted.	Nearly all extracted.	>½	>½
52	Tyemond orange (R. H.). (Mixture.)	0	Nearly 0	<½ Yellow; H_2O solution, orange.	<½	<½ Yellow.	Nearly all extracted. Orange; H_2O solution, pink.	>½	>½	Nearly all extracted. Orange.
53	Crocein orange Y (Sch.).	0	0	½	All extracted.	>½	All extracted.	>½	½	>½
54	Orange I.	Nearly 0 Pale yellow.	0 H_2O Scarlet.	½ Yellow orange.	½	<½ orange. H_2O scarlet.	All extracted. Orange.	>½	½ Orange red.	>½ Orange.
55	Crocein orange G (By.).	0	0	½	>½	½	All extracted.	Nearly all extracted.	½	Nearly all extracted.
56	Ponceau 4 GB (Berlin).	0	0	½	All extracted.	Nearly all extracted.	All extracted.	Nearly all extracted.	Nearly all extracted.	All extracted.
57	Orange G (Berlin).	0	0	0	0	0	½	½	<½	½
58	Orange G (R. H.).	0	0	½	>½	½	All extracted.	>½	>½	>½

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
59	Orange GG crystals (Cassella).	0	0	0	0	0	>½	<½ Yellow.	<½ Yellow.	½
60	Auramine.	Nearly 0	All extracted.	0	All extracted.	All extracted.	Nearly all extracted.	>½	Nearly all extracted.	½
61	Naphthol yellow (Bad.).	0 H_2O solution, yellow.	0 H_2O solution, yellow.	0 H_2O solution, yellow.	Nearly 0	Nearly 0	<½	½	½	>½
62	Yellow YM (R. H.).	0	0	½	<½	Nearly 0	½	½	½	>½
63	Naphthol yellow or naphthylamin yellow (Grübler).	All extracted.	½	All extracted.	½	½	½	All extracted.	All extracted.	All extracted.
64	Martius yellow.	>½	½	All extracted. Pale yellow.	½	½	All extracted. Pale yellow.	All extracted.	Nearly all extracted.	All extracted. Yellow.
65	Picric acid.	½	<½	All extracted.	½	<½	All extracted.	>½	>½	>½
66	Chrysamin.	All extracted.	<½	All extracted.	>½	½ Yellow; H_2O orange.	All extracted.	Nearly all extracted.	P <½	All extracted.
67	Fast yellow (Bad.).	0	0	0	Nearly 0	Nearly 0	Nearly 0	½	½	<½

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
68	Wool yellow T extra (Sch.).	0	0	0	0	0	½ Yellow.	Nearly 0 Pale yellow.	0 H_2O solution, yellow.	<½ Yellow.
69	Tartrazin (Bad.).	0	0	0	0	0	<½	0	0	½
70	Metanil yellow (Oehler).	<½	<½	½ Yellow.	>½	½	Nearly all extracted. Brown red.	Nearly all extracted. Yellow.	>½	>½
71	Brilliant yellow S (Sch.).	0	0	0 H_2O solution, orange.	0	0	0 H_2O solution, orange.	0	0	Nearly 0 Yellowish.
72	"Chinolin yellow" (R. H.).	Nearly 0	Nearly 0	½	½	½	>½	½	½	>½
73	Chrysoïdin (Grübler).	½	All extracted.	<½	½	Nearly all extracted.	Nearly all extracted.	Nearly all extracted. Orange.	All extracted.	>½
77	Malachite green (Berlin).	Nearly 0	All color extracted. Colorless.	½ Greenish blue.	All extracted. Deep blue.	All extracted. Colorless.	All extracted.	Nearly all extracted. Deep blue.	All extracted. Colorless.	Nearly all extracted. Greenish blue.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
78	Ethyl green (Berlin).	Nearly 0	All color extracted. Colorless.	All color extracted. Greenish blue.	All extracted. Deep blue.	All extracted. Colorless.	All extracted. Pale green blue.	All extracted. Deep blue.	All extracted. Colorless.	All extracted. Pale green blue.
79	Acid green 780 (Cassella).	0	0 H_2O solution, nearly colorless.	0 H_2O solution, pale green.	$<\frac{1}{2}$ Blue.	0	$\frac{1}{2}$ Greenish blue.	0	0 H_2O solution, colorless.	0
80	Acid green OO (Sch.).	0	0	0	0	0	$>\frac{1}{2}$ Blue green.	0	0	Nearly 0
81	Cyanole green 6 G (Cassella).	0	0 H_2O solution, blue.	0 H_2O solution, yellow green.	$>\frac{1}{2}$ Deep blue; H_2O solution, pale green.	0 H_2O solution, deep blue.	$\frac{1}{2}$ Same as acetone.	$>\frac{1}{2}$	0 Colorless; H_2O solution, blue.	$\frac{1}{2}$ Blue; H_2O solution, yellow green.
82	Naphthol green B (Cassella).	0	0 H_2O solution, yellow green.	0 H_2O solution, green.	0	0	$\frac{1}{2}$ Brownish yellow; H_2O solution, yellow.	0	0	0
83	Azo blue (By.).	0	0	Dark blue precipitate. Solvent pink; H_2O solution, pink.	$\frac{1}{2}$ Crimson.	$<\frac{1}{2}$	Nearly all extracted. Magenta.	$\frac{1}{2}$	$<\frac{1}{2}$	Nearly all extracted. Crimson.
84	Cyanole FF (Cassella).	0 H_2O solution, blue.	0 H_2O solution, blue.	0 H_2O solution, green.	$<\frac{1}{2}$ Blue.	0	$\frac{1}{2}$ Blue; H_2O solution, green.	$\frac{1}{2}$ Blue.	0	$\frac{1}{2}$ Blue; H_2O solution, green.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
85	Methylene blue (Bad.).	0	0	0	½ Blue.	½	½	>½ Blue.	>½	½
86	Tetracyanole SF (Cassella).	0	0	0	0	0	Very little extracted. Blue; H_2O solution, green.	½	Nearly 0	<½ Blue; H_2O solution, green yellow.
87	Methyl violet DB (Sch.).	Nearly 0	½	<½ Violet; H_2O solution, green.	Nearly all extracted.	All extracted. Violet.	½ H_2O solution, green.	Nearly all extracted.	>½	½ H_2O solution, blue.
88	Methylene violet 2 BX (Berlin).	Nearly 0	½	<½ Violet; H_2O solution, blue.	½	All extracted. Violet.	All extracted. Violet.	Neary all extracted. Violet.	All extracted. Violet.	>½ H_2O solution, blue.
89	Indigo disulpho-acid.	0	0	0	0	0	Nearly 0 Blue.	<½ Blue.	Nearly 0 Greenish blue; H_2O blue turning olive green.	<½
90	Bismarck brown extra (Berlin).	<½ Orange.	Nearly all extracted. Brown orange.	0	½	Nearly all extracted. Brown orange.	½	>½	Nearly all extracted. Brown orange.	½
91	Fast brown G (Berlin).	0	0 H_2O solution, crimson.	½	All extracted.	<½ Crimson; H_2O solution, magenta.	All extracted. Magenta.	>½ Brown; H_2O solution, purple.	½	>½ Wine red.
92	Naphthol black BDF (Cassella).	0 Purple.	0 H_2O purple.	0	0	0 H_2O violet.	0	0	0 H_2O blue.	0
93	Naphthol blue black.	0	0	½ Purple.	0	0	All extracted. Deep crimson.	½ Deep crimson. H_2O blue.	½ Blue.	½ Deep crimson. H_2O blue.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

NATURAL COLORS.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
94	Cochineal.	0	0	½ Orange.	Nearly 0	0	Nearly all extracted. Orange.	0	0	>½ Orange.
95	Cudbear.	½ Wine red; H_2O solution, purple.	<½ Wine red; H_2O solution, purple.	½ Scarlet; H_2O solution, deep pink.	Nearly all extracted. Wine red.	<½ Purple.	Nearly all extracted. Wine red.	>½ Crimson.	½	>½ Crimson.
96	Archil.	<½ Red orange.	<½ Deep pink.	½ Orange red.	½ Scarlet; H_2O solution, magenta.	<½ Magenta; H_2O solution, purple.	>½ Wine red.	½ Scarlet.	½ Crimson.	Nearly all extracted. Wine red.
97	Litmus.	0	0	0	0	0	½ Pink.	0	0	Nearly all extracted. Deep yellow pink.
98	Azo litmin.	0	0	0	0	0	<½ Pink.	0	0	>½ Deep pink.
101	Logwood extract.	Nearly all extracted. Brown.	0	<½ Brown yellow.	All extracted. Brown.	Nearly 0 Pinkish; H_2O solution, deep brown.	½ Brown.	>½ Red orange; H_2O solution, magenta.	0 H_2O solution, purple.	½ Red brown.
102	Brazil-wood extract.	Nearly all extracted. Yellow.	Nearly 0 Colorless; H_2O solution, wine red.	>½ Orange yellow.	All extracted. Yellow.	Nearly 0 Pink; H_2O solution, wine red.	>½ Orange.	½ Orange; H_2O solution, pink.	0	Nearly all extracted. Orange.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

NATURAL COLORS—Continued.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
104	Catechu.	0	0	Nearly 0	0	0	Nearly 0	½	0	<½ Brown.
106	Saffron.	<½	<½	<½	½ Orange.	<½ Yellow.	½ Orange yellow.	<½ Yellow.	½ Yellow.	½
107	Aloes.	½ Yellow.	<½ Orange; H_2O solution, red brown.	<½ Red orange; H_2O solution, brown red.	>½	<½ Red brown.	<½ Scarlet.	>½ Brown yellow.	Nearly 0 Yellow; H_2O solution, brown.	½ Brown yellow; H_2O solution, pale yellow.
108	Quercitron extract.	>½ Yellow.	Nearly 0 H_2O solution, brown.	Nearly all extracted. Yellow.	>½ Yellow; H_2O solution, light brown.	0 H_2O solution, brown.	>½ Brown yellow; H_2O solution, brown.	Nearly all extracted.	0	>½
109	Sumac extract.	>½ Pale yellow.	0	½	Nearly all extracted. Yellow.	0	Nearly all extracted. Yellow.	>½ Yellow.	0 H_2O solution, olive green.	>½ Yellow brown.
110	Annatto.	.....	>½ Orange.	Nearly all extracted. Orange.	.....	>½ Orange.	Nearly all extracted. Orange.	.....	>½ Orange.	All extracted.
111	Turmeric.	>½ Yellow.	All extracted. Yellow.	>½ Yellow.	>½ Yellow.	0	Nearly all extracted. Yellow.	All extracted. Yellow.	Nearly 0 Yellow.	All extracted. Yellow.
112	Persian berry extract.	<½ Yellow.	Nearly 0	<½	<½ Yellow; H_2O solution, yellow brown.	<½ Yellow.	<½ Yellowish.	½ Yellow; H_2O solution, yellow.	<½	>½ Yellow; H_2O solution, brownish.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

NATURAL COLORS—Continued.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
113	Fustic extract.	½	Nearly 0	<½ Yellow.	Nearly 0	Nearly 0	Nearly all extracted. Yellow brown.	>½ Yellow brown.	<½ Yellow.	Nearly all extracted. Yellow brown.
114	Weld extract.	0	0	<½ Yellow.	<½ Yellow.	<½ Yellow.	<½ Nearly colorless.	<½ Yellow.	<½ Yellow.	>½ Brown yellow.
116	Buckthorn berries.	½ Yellow.	<½ Yellow.	>½	>½ Yellow.	<½ Bright orange.	Nearly all extracted. Yellow.	All extracted. Yellow; H_2O solution, light brown.	0 H_2O solution, brown.	>½ Yellow.
117	Strawberry juice, fresh.	.....	0 H_2O solution, magenta.	Nearly 0	.....	<½ Colorless; H_2O solution, magenta.	½ Scarlet.	.....	½ Light brown; H_2O solution, dark-gray brown.	>½ Scarlet.
118	Blackberry juice, old.	.....	0 H_2O solution, blue.	0	.....	0 H_2O solution, blue gray.	0	.....	0 H_2O solution, gray blue.	Nearly 0 Pale pink.
119	Red raspberry juice, old.	.....	0 H_2O solution, deep blue.	0	.....	0 H_2O solution, deep blue.	0 H_2O solution, magenta.	.....	0 Yellow.	0 Orange.
120	Dark, sweet cherry juice, fresh.	.....	0 H_2O solution, dark purple.	0	.....	0 H_2O solution, green brown.	Nearly 0 Pink.	.....	0 H_2O solution, brown green.	<½ Orange red; H_2O solution, same.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

NATURAL COLORS—Continued.

No.	Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from aqueous color solution saturated with salt.		
		Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
121	Grape juice, Concord.	.....	0	0	.....	0 H_2O solution, brown green.	<½ Deep pink.	.....	0 H_2O solution, brown green.	½ Wine red.
122	Poke-berry extract.	0 H_2O solution, crimson.	0 Yellowish; H_2O solution, brown.	0	0	0 Yellowish; H_2O solution, brown.	<½ Purple.	Nearly 0 Pink.	0 Yellowish; H_2O solution, brown green.	>½ Purple.
123	Spinach green.	>½ Green yellow.	Nearly all extracted. Yellow green.	Nearly all extracted. Yellow green.	½ Yellow green.	Nearly all extracted. Greenish yellow.	Nearly all extracted. Greenish yellow.	Nearly all extracted.	Nearly all extracted. Brown.	All extracted. Green brown.
124	Carmin (Grübler).	0	0	½ Orange.	0	0	½ Red orange; H_2O solution, pink.	0	0	>½ Orange red.
125	Tomato color.	>½ Orange.	>½ Orange.	>½ Orange.	All extracted. Orange yellow.	All extracted. Orange.	All extracted. Orange.	All extracted. Orange.	All extracted.	All extracted.

TABLE III.—COLOR REACTIONS OF DYED FIBER (WOOL).

COAL-TAR COLORS.

No.	Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
		Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
1	Ponceau red (Grübler).	Crimson.	Pink.	Scarlet.	Scarlet.	Orange red.	.....	No change.	Red.
2	Ponceau 6 R (M. L. B.).	Crimson.	Red.	Violet.	Violet.	Brown.	Brown.	No change.	Red.
3	Scarlet 6 R (M. L. B.).	Scarlet.	.....	Lilac.	.....	Orange brown.	.....	Darker.	Red.
4	New coccin (Berlin).	Orange red.	Red.	Purple.	Purple.	Light brown.	Light brown.	No change.	Reddish.
5	Cochineal red A (Bad.).	Crimson.	Red.	Deep crimson.	Pink.	Yellow brown.	Yellow brown.	No change.	Red.
6	Ponceau 4 RB (Berlin).	Dark blue.	Blue.	Dark blue.	Blue.	Dark crimson.	.....	No change.	Red.
7	Croceïn scarlet 3 B (By.).	Dark blue.	Blue.	Dark blue.	Blue.	Violet brown.	.....	No change.	Red.
8	Croceïn scarlet 7 B (By.).	Blue.	Blue.	Blue.	Blue.	Maroon.	.....	No change.	Red.
9	Fast ponceau B (Bad.).	Dark blue.	Blue.	Deep green.	Green.	Brown violet.	.....	No change.	.....
10	Biebrich fast scarlet O (Kalle).	Dark blue.	Blue.	Dark blue.	Blue.	Purple.	.....	No change.	.....

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
		Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
11	Biebrich croceïn scarlet O (Kalle).	Dark blue.	Blue.	Dark blue.	Blue.	Dark brown.	.....	No change.	Red.
12	Biebrich croceïn scarlet OO (Kalle).	Dark blue.	Blue.	Dark blue.	Blue.	Brown.	.....	No change.	Red.
13	Biebrich brilliant croceïn scarlet O (Kalle).	Dark blue.	Blue.	Purple.	Purple.	Dark brown.	.....	No change.	Red.
14	Biebrich brilliant croceïn scarlet ON (Kalle).	Dark blue.	Blue.	Purple.	Purple.	Dark brown.	.....	No change.	Pink.
15	Scarlet RD (R. H.) (mixture).	Crimson.	.....	Red.	Red.	Yellower.	.....	No change.	.....
16	Ponceau 2 R (Sch.).	Rose red.	.....	Darker.	Red.	Orange.	.....	No change.	.....
17	Ponceau 3 R (Sch.).	Rose red.	.....	Scarlet.	Red.	Orange.	.....	No change.	.....
18	Brilliant cochineal 2 R (Cassella).	Darker.	.....	Crimson.	.....	Brownish yellow.	.....	No change.	Red.
19	Fast red A (Bad.).	Purple.	Purple.	Violet.	Violet.	Deep orange brown.	Red.	No change.	.....

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
		Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
20	Fast red B (Bad.).	Purple.	.....	Dark blue.	Blue.	Light orange brown.	.....	No change.	.....
21	Bordeaux B (Berlin).	Bluer.	Colorless.	Blue.	Blue.	Orange red.	Red.	No change.	Colorless.
22	Fast red C (Bad.).	Crimson.	.....	Purple violet.	Violet.	Scarlet.	Red.	Redder.	Red.
23	Azo-rubin (Sch.).	Crimson.	.....	Violet.	Violet.	Red.	Red.	No change.	Red.
24	Carmosin B (R. H.).	No change.	.....	Purple.	.....	Yellower.	Pink.	No change.	Pink.
25	Fast red D (Bad.).	Dark violet.	Violet.	Violet.	Violet.	Red brown.	Red.	No change.	.....
26	Amaranth B (Cassella) (mixture).	Violet.	.....	Greenish blue.	Blue.	Dark violet.	.....	No change.	.....
27	Amaranth (Sch.).	Darker.	.....	Violet.	Violet.	Partly decolorized.	.....	No change.	Red.

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
		Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
28	Archil substitute (R. H.).	Light magenta.	Light magenta.	Darker.	.....	Darker.	.....	No change.	.....
29	Archil substitute 3 VN (St. Denis).	Magenta.	.....	Darker.	.....	Darker.	.....	Lilac.	.....
30	Lanafuchsin 6 B (Cassella).	Rose red.	.....	Deep pink.	Red.	Deep pink.	.....	Nearly decolorized.	.....
31	Magenta.	Yellow brown.	Yellow.	Dirty violet.	Yellow.	Decolorized.	.....	Decolorized.	.....
32	Acid magenta (Bad. and Berlin).	Nearly or wholly decolorized.	.....	Yellow.	.....	Decolorized.	.....	Decolorized.	.....
33	Safranin (B. S. S.).	Greenish blue.	Greenish blue.	Green.	.....	Crimson.	.....	Crimson.	.....
34	Benzopurpurin.	Blue.	.....	Blue.	.....	No change.	.....	No change.	.....
35	Congo red.	Blue.	Colorless.	Blue.	Blue.	No change.	.....	No change.	.....
36	Eosin (mixture).	Yellow.	.....	Yellow.	.....	Yellowish pink.	.....	No change.	.....
37	Eosin A (Bad.).	Yellow.	.....	Yellow.	.....	Darker.	Pink.	No change.	Pink.

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
		Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
38	Azo eosin (By.).	Crimson.	Crimson.	Crimson.	Crimson.	Orange.	Orange.	Orange red.	Orange.
39	Phloxin (Bad.).	Yellow.	.....	Orange yellow.	Orange yellow.	No change.	.....	No change.	.....
40	Rose bengal (Bad.).	Yellowish.	.....	Orange.	.....	No change.	.....	No change.	Pink.
41	Rhodamin (Bad.).	Orange.	Orange.	Yellow.	.....	No change.	.....	No change.	Pink.
42	Pink M (R. H.).	Pinkish yellow.	.....	Yellowish.	.....	Darker.	.....	No change.	.....
43	Fast pink B (Sch.).	Yellowish.	.....	Yellow.	.....	Bluer.	.....	No change.	Pink.
44	Erythrosin.	Orange yellow.	.....	Orange yellow.	Yellow.	No change.	Pink.	No change.	Pink.
45	Tropæolin O (Cassella).	Orange.	Yellow.	Orange.	Yellow.	Orange red.	Orange.	No change.	Yellow.

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
		Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
46	Tropæolin OO (Cassella).	Magenta.	Magenta.	Deep violet.	Violet.	No change.	.....	No change.	.....
47	Orange IV (R. H.).	Magenta.	Magenta.	Deep violet.	Violet.	No change.	.....	No change.	Yellow.
48	Methyl orange.	Scarlet.	Red.	Brown yellow.	.....	No change.	Colorless.	No change.	Orange yellow.
49	Orange extra (Cassella).	Crimson.	.....	Crimson.	.....	Orange red.	.....	No change.	.....
50	Orange II (St. Denis).	Crimson.	Crimson.	Crimson.	Crimson.	Orange red.	Red.	No change.	Orange.
51	Orange II (By.).	Scarlet.	Red.	Crimson.	.....	Red orange.	Orange.	No change.	.....
52	Tyemond orange Y (R. H.). (Mixture.)	Violet.	.....	Magenta.	Red.	No change.	.....	No change.	.....
53	Crocein orange Y (Sch.).	Redder.	Red.	Darker.	Red.	Orange red.	Orange.	No change.	.....
54	Orange I.	Purple.	.....	Purple.	.....	Red.	.....	Red.	.....

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
		Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
55	Croceïn orange G (By.).	Orange red.	.....	Orange.	.....	Darker.	.....	No change.	.....
56	Ponceau 4 GB (Berlin)	Orange red.	.....	Orange.	.....	Little darker.	.....	No change.	.....
57	Orange G (Berlin).	Darker.	.....	Orange.	.....	Terra cotta.	.....	No change.	.....
58	Orange G (R. H.).	Crimson.	.....	Crimson.	.....	Red orange.	.....	No change.	.....
59	Orange GG (Cassella).	Darker.	.....	Orange.	.....	Terra cotta.	.....	No change.	.....
60	Auramine.	Decolorized.	.....	Nearly decolorized.	.....	No change.	.....	Paler.	.....
61	Naphthol yellow (Bad.).	Decolorized.	.....	Paler.	.....	No change.	Yellow.	No change.	Yellow.
62	Yellow YM (R. H.).	Nearly decolorized.	.....	Paler.	.....	No change.	Yellow.	No change.	Yellow.
63	Naphthol yellow (Grübler).	Decolorized.	.....	Paler.	.....	No change.	Yellow.	No change.	Yellow.
64	Martius yellow.	Paler.	.....	Brownish yellow.	.....	Deeper.	Yellow.	Deeper.	Yellow.

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
		Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
65	Picric acid.	Decolorized.	.....	Yellowish.	.....	Darker.	Yellow.	No change.	Yellow.
66	Chrysamin.	Pale brown.	.....	Crimson.	Crimson.	Red orange.	Orange.	Darker.	.....
67	Fast yellow (Bad.).	Red.	Orange red.	Orange.	.....	Darker.	.....	No change.	Yellow.
68	Wool yellow T (Sch.).	No change.	Yellow.	No change.	Yellow.	No change.	Yellow.	No change.	Yellow.
69	Tartrazin (Bad.).	Darker.	.....	Darker.	.....	No change.	Yellow.	No change.	Yellow.
70	Metanil yellow (Oehler).	Magenta.	Magenta.	Dark violet.	Violet.	No change.	.....	No change.	Yellow.
71	Brilliant yellow S (Sch.).	Magenta.	Magenta.	Magenta.	Magenta.	Little darker.	Yellow.	No change.	.....
72	"Chinolin yellow" (R. H.).	Darker.	.....	Brownish yellow.	.....	Paler.	.....	No change.	.....

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
		Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
73	Chrysoïdin.	Brown.	.....	Maroon.	Yellow.	No change.	.....	No change.	.....
a74	Sudan I.	Crimson.	.....	Crimson.	.....	Darker.	.....	No change.	.....
a75	Sudan brown (Berlin).	Blue.	.....	Green.	.....	Darker.	.....	No change.	.....
a76	Sudan G.	Yellow brown.	.....	Yellow brown.	.....	Redder.	.....	Yellow.	Yellow.
77	Malachite green (Berlin).	Decolorized.	Yellowish.	Decolorized.	Yellowish.	Decolorized.	.....	Decolorized.	.....
78	Ethyl green (Berlin).	Decolorized.	.....	Yellowish.	.....	Decolorized.	.....	Decolorized.	.....
a78½	Sudan III.	Purple or violet.	.....	Bluish green.	.....	Purple or violet.	.....	No change.	.....
79	Acid green 780 (Cassella).	Yellow.	.....	Orange.	.....	Decolorized.	.....	Decolorized.	.....
80	Acid green OO (Sch.).	Yellow.	.....	Orange.	.....	Nearly decolorized.	.....	Nearly decolorized.	.....

a Dyed on silk fiber from dilute alcoholic solution.

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
		Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
81	Cyanole green 6 G (Cassella).	Orange.	.....	Yellowish.	.....	Darker.	.....	No change.	.....
82	Naphthol green B (Cassella).	Yellowish.	.....	Brownish yellow.	.....	No change.	.....	No change.	.....
83	Azo blue (By.).	Darker.	.....	Greenish blue.	.....	Rose red.	.....	Purple.	.....
84	Cyanole FF (Cassella).	Yellow.	.....	Yellowish.	.....	Yellow green.	.....	No change.	Blue.
85	Methylene blue (Bad.).	Decolorized.	.....	Yellowish.	.....	Decolorized.	.....	No change.	.....
86	Tetracyanole SF (Cassella).	Yellow.	.....	Yellowish.	.....	Darker.	Blue.	Darker.	Blue.
87	Methyl violet DB (Sch.).	Yellowish.	.....	Yellowish.	.....	Decolorized.	.....	Nearly decolorized.	.....

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

COAL-TAR COLORS—Continued.

No.	Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
		Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
88	Methylene violet 2 BX (Berlin).	Yellow.	.....	Yellow.	.....	Decolorized.	.....	Nearly decolorized.	.....
89	Indigo disulpho-acid.	Darker.	Blue.	Darker.	Violet blue.	Yellow.	Yellow.	Greenish blue.	Green.
90	Bismarck brown (Berlin).	Darker and redder.	.....	Browner.	.....	Yellower.	.....	Yellower.	.....
91	Fast brown G (Berlin).	Violet.	.....	Violet.	.....	Rose.	.....	Rose.	.....
92	Naphthol black BDF (Cassella).	Greenish blue.	.....	Olive green.	.....	Black.	.....	No change.	.....
93	Naphthol blue black (Cassella).	Darker	.....	Darker.	.....	Darker.	Green blue.	No change.	Green blue.
	NATURAL COLORS.								
94	Cochineal.	No change.	.....	Brighter red.	.....	Magenta.	Magenta.	Crimson.	.....

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

NATURAL COLORS—Continued.

No.	Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
		Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
95	Cudbear.	Deep pink.	.....	Dark gray.	.....	Violet.	.....	Violet.	.....
96	Archil.	Deep pink.	.....	Bluish gray.	.....	Purple.	.....	Purple.	.....
97	Litmus.	Pink.	.....	Brownish.	.....	Blue.	.....	Blue.	.....
98	Azo litmin	Pink.	.....	Brownish.	.....	Blue.	.....	Blue.	.....
101	Logwood, chrome-mordanted cotton.	Red.	Red.	Brown.	.....	Black brown.	.....	Pale brown.	.....
102	Brazil wood, chrome-mordanted cotton.	Orange red.	Red.	Yellow brown.	.....	Maroon.	Maroon.	Purple.	Maroon.
103	Barwood.	Yellow pink.	.....	Yellow brown.	.....	Maroon.	.....	Blue black.	.....
104	Catechu.	Brown.	.....	Dark brown.	.....	Brown.	.....	Brown.	.....

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

NATURAL COLORS—Continued.

No.	Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
		Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
106	Spanish saffron.	Darker.	.....	Olive green, changing to maroon.	.....	No change.	.....	No change.	.....
108	Quercitron, alum-mordanted cotton.	No change.	Yellow.	No change.	.....	No change.	Yellow.	No change.	Yellow.
109	Sumac.	No change.	.....	Yellow brown.	.....	Brownish yellow.	.....	No change.	.....
110	Annatto.	Pale brown.	.....	Green.	.....	No change.	.....	No change.	.....
111	Turmeric.	Deep crimson.	.....	Orange brown.	.....	Orange.	.....	Orange.	.....
112	Persian berry extract.	Darker.	.....	Brownish yellow.	.....	Little darker.	.....	Darker.	.....
113	Fustic extract.	Orange yellow.	.....	Yellow brown.	.....	Orange yellow.	.....	Orange yellow.	.....
114	Weld, extract.	No change.	.....	Brownish yellow.	.....	Slightly deeper.	.....	Slightly deeper.	.....
116	Buckthorn.	No change.	.....	Brown yellow.	.....	No change.	.....	No change.	.....
116½	Kamala.	No change.	.....	Darker.	.....	Brown orange.	.....	No change.	.....
122	Poke berry.	Little change.	.....	Yellow brown.	.....	Yellow.	.....	Yellow.	.....
126	Carthamin, on cotton.	Orange.	.....	Brown.	.....	Yellow brown.	.....	Pinkish yellow.	.....

TABLE IV.—APPEARANCE AND REACTIONS OF COLORS IN AQUEOUS SOLUTION AND WITH CONCENTRATED SULPHURIC ACID.

No.	Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
			Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
1	Ponceau red (Grübler).	Orange red.	No change.	Yellower.	No change.	Color not restored.	Orange red.	Scarlet, then orange red.
2	Ponceau 6 R (M. L. B.).	Pink.	No change.	Dirty yellow.	Paler.	Color not restored.	Purple.	Crimson, then scarlet.
3	Scarlet 6 R (M. L. B.).	Pink.	No change.	Dirty yellow.	Paler.	Color not restored.	Purple.	Crimson, then scarlet.
4	New coccin (Berlin).	Pink.	No change.	Dirty yellow.	Paler.	Color not restored.	Magenta.	Crimson, then orange red.
5	Cochineal red A (Bad.).	Yellowish pink.	No change.	Dirty yellow.	Paler.	Color not restored.	Magenta.	Magenta, then orange red.
6	Ponceau 4 RB (Berlin).	Pink.	No change.	Paler and bluer.	No change.	Color not restored.	Dark blue.	Purple, then brown precipitate, then clear red solution.
7	Croceïn scarlet 3 B (By.).	Pink.	No change.	Purplish blue.	No change.	Color not restored.	Dark blue.	Blue, then purple, then red.
8	Croceïn scarlet 7 B (By.).	Pink.	No change.	Bluer.	No change.	Color not restored.	Dark blue.	Blue, then purple with brown precipitate, then clear red solution.
9	Fast ponceau B (Bad.).	Red orange.	No change.	Purple.	No change.	Color not restored.	Dark bluish-green.	Blue, then maroon precipitate, then clear orange red solution.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

No.	Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
			Hydrochloric acid, 1.10. (5–10 drops)	10 per cent sodium hydrate solution. (5–10 drops).	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
10	Biebrich fast scarlet O (Kalle).	Cherry red.	Slight excess HCl no change; large excess HCl violet.	Crimson.	Crimson.	Color not restored.	Dark blue.	Blue, then brown, and finally orange.
11	Biebrich croceïn scarlet O (Kalle).	Orange.	Slight excess HCl darker; large excess HCl lilac.	Magenta brown.	No change.	Color not restored.	Dark blue.	Blue, then violet, then orange-pink.
12	Biebrich croceïn scarlet OO (Kalle).	Orange red.	No change; large excess HCl, magenta solution; brown precipitate after some time.	Crimson.	No change.	Color not restored.	Dark blue.	Dark blue, then purple, then pink, with brown precipitate.
13	Biebrich brilliant croceïn scarlet O (Kalle).	Orange.	Slight excess HCl no change; large excess HCl gives lilac, then blue with brown precipitate.	Brown.	Orange brown.	Color not restored.	Magenta.	Violet blue, then pale magenta with brown precipitate.
14	Biebrich brilliant croceïn scarlet ON (Kalle).	Red orange.	No change; large excess HCl gives magenta solution and brown precipitate.	Orange brown.	Darker.	Color not restored.	Magenta.	Dark purple, then violet blue, then pink and brown precipitate.
15	Scarlet RD (R. H.). (Mixture.)	Red orange.	No change.	No change.	No change.	Color not restored.	Crimson.	Crimson, then orange.
16	Ponceau 2 R (Sch.).	Orange.	No change.	Brownish yellow.	No change.	Color not restored.	Cherry red.	Scarlet, then orange.
17	Ponceau 3 R (Sch.).	Red orange.	No change.	Brownish yellow.	No change.	Color not restored.	Cherry red.	Cherry red, then orange.
18	Brilliant cochineal 2 R (Cassella).	Orange red.	No change.	Brownish yellow.	No change.	Color not restored.	Crimson.	Orange red.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

No.	Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
			Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
19	Fast red A (Bad.).	Orange red.	Brown yellow, red brown precipitate.	No change.	No change.	Color not restored.	Purple.	Purple, then yellow brown precipitate.
20	Fast red B (Bad.).	Magenta.	No change.	Pinkish yellow.	Yellowish pink.	Color not restored.	Dark blue.	Purple, then maroon precipitate, then clear magenta solution.
21	Bordeaux B (Berlin).	Magenta.	No change.	Red orange.	Paler.	Color not restored.	Dark blue.	Purple, then magenta.
22	Fast red C (Bad.).	Orange red.	Redder.	No change.	No change.	Color not restored.	Violet.	Wine red solution and precipitate, then clear red solution.
23	Azo rubin (Sch.).	Orange red.	Redder.	No change.	No change.	Color not restored.	Purple-violet.	Magenta, then crimson.
24	Carmosin B (R. H.).	Orange red.	Magenta and stringy brown precipitate.	No change.	No change.	Color not restored.	Violet.	Magenta.
25	Fast red D (Bad.).	Orange pink.	Brownish yellow.	Pink.	No change.	Color not restored.	Purple.	Brown red precipitate.
26	Amaranth B (Cassella). (Mixture).	Crimson.	Bluer.	Purple.	Bluer.	Color not restored.	Dark blue.	Dark crimson.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

No.	Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color+concentrated sulphuric acid.	
			Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
27	Amaranth (Sch.).	Light magenta.	Slightly bluer.	Slightly bluer.	No change.	Color not restored.	Purple-violet.	Magenta, then crimson.
28	Archil substitute (R. H.).	Brown orange.	Red brown precipitate.	Red brown precipitate.	No change.	Color not restored.	Crimson.	No change.
29	Archil substitute 3 VN (St. Denis).	Orange pink.	Magenta.	Paler.	No change.	Color not restored.	Magenta.	Magenta or crimson.
30	Lanafuchsin 6 B (Cassella).	Magenta.	No change.	Pale yellowish pink.	Pale yellowish pink.	Color not restored.	Orange red.	Light crimson.
31	Magenta.	Crimson.	Brownish yellow.	Color gradually fades away.	Color gradually fades away.	Color not restored.	Orange yellow.	Yellow.
32	Acid magenta (Bad. and Berlin).	Crimson.	Little darker.	Decolorized.	Decolorized.	Color not restored.	Orange yellow.	Magenta.
33	Safranin (B. S. S.).	Red.	Magenta.	No change.	No change.	Color restored.	Dark green.	Blue green, blue violet, and magenta.
34	Benzopurpurin.	Orange red.	Dark blue and precipitate.	No change.	No change.	Color not restored.	Dark blue.	Blue precipitate.
35	Congo red.	Orange red.	Dark blue and precipitate.	No change.	No change.	Color not restored.	Dark blue.	Blue precipitate.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

No.	Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color+concentrated sulphuric acid.	
			Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
36	Eosin (mixture).	Pink, fluorescent.	Yellow, orange precipitate.	No change.	No change.	Color not restored.	Yellow.	Orange precipitate.
37	Eosin A (Bad.).	Yellowish-pink, fluorescent.	Yellow, orange precipitate.	No change.	No change.	Color not restored.	Yellow.	Orange precipitate.
38	Azo-eosin (By.).	Pink.	No change.	Brownish yellow.	Brownish yellow.	Color not restored.	Crimson.	Crimson, then brown-red precipitate, then clear pink solution.
39	Phloxin (Bad.).	Pink, fluorescent.	Decolorized, orange precipitate.	No change.	No change.	Color not restored.	Orange yellow.	Yellow, then colorless.
40	Rose bengal (Bad.).	Pink.	Decolorized, red precipitate.	No change.	No change.	Color not restored.	Orange.	Orange precipitate, turning pink.
41	Rhodamin (Bad.).	Pale magenta, fluorescent.	Paler.	No change.	No change.	Color not restored.	Yellow.	Orange red, then pink.
42	Pink M (R. H.).	Pale magenta, fluorescent.	Pink, less fluorescent.	No change.	No change.	Color slowly restored.	Yellow.	Orange, then pink.
43	Fast pink B (Sch.).	Pale magenta, fluorescent.	Pale pink, not fluorescent.	No change.	No change.	Color not restored.	Yellow.	Orange, then pink.
44	Erythrosin.	Yellowish pink.	Yellower, slightly cloudy, then orange precipitate.	Pink.	No change.	.....	Orange yellow.	Orange precipitate.
45	Tropæolin O (Cassella).	Orange yellow.	No change.	Red orange.	Orange.	Color not restored.	Orange.	Orange.
46	Tropæolin OO (Cassella).	Yellow.	Magenta.	Little darker, turbid.	No change.	Color not restored.	Purple.	Magenta.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

No.	Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
			Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
47	Orange IV (R. H.).	Pale orange (not very soluble).	Magenta.	No change.	No change.	Color not restored.	Violet.	Magenta.
48	Methyl orange.	Orange.	Pink.	No change.	No change.	Color not restored.	Brownish red.	Orange red.
49	Orange extra (Cassella).	Orange.	No change.	Pink.	Redder.	Color not restored.	Crimson.	Crimson, then orange; flocculent red-brown precipitate.
50	Orange II (St. Denis).	Orange.	Orange, stringy brown precipitate.[a]	Orange red.	Red orange.	Color not restored.	Magenta.	Cherry red, then orange.
51	Orange II (By.).	Orange.	No change.	Orange red.	Orange red.	Color not restored.	Crimson.	Orange solution and brown precipitate.
52	Tyemond orange Y (R. H.). (Mixture).	Orange.	Brown.	Yellow.	No change.	Color not restored.	Magenta.	Violet precipitate.
53	Croceïn orange Y (Sch.).	Orange yellow.	No change.	Darker.	Darker.	Color not restored.	Orange.	Paler.
54	Orange I.	Orange.	Redder; large excess HCl = magenta.	Orange red.	Orange red.	Color not restored.	Magenta.	Crimson, then orange.

[a] No change; stringy, brown precipitate in more concentrated solution.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

No.	Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
			Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
55	Croceïn orange G (By.).	Orange.	No change.	Redder.	Redder.	Color not restored.	Brownish orange.	Orange red, then orange.
56	Ponceau 4 GB.	Orange.	No change.	Redder.	Redder.	Color not restored.	Orange.	Orange-red, then orange.
57	Orange G (Berlin).	Orange.	No change.	Pink.	No change.	Color not restored.	Orange.	Orange red, then orange.
58	Orange G (R. H.).	Orange.	No change.	Pink or orange red.	Red orange.	Color not restored.	Crimson.	Crimson, then orange, and a precipitate.
59	Orange GG (Cassella).	Orange.	No change.	Pink.	No change.	Color not restored.	Orange yellow.	Orange, then orange yellow.
60	Auramine.	Yellow.	No change.	Decolorized; white precipitate.	Paler; white precipitate.	Color not restored.	Colorless.	Yellow.
61	Naphthol yellow (Bad.).	Yellow.	Decolorized, clear solution.	No change.	No change.	Color not restored.	Yellow.	Yellow.
62	Yellow YM (R. H.).	Yellow.	Nearly decolorized.	No change.	No change.	Slowly turns red.	Yellow.	Yellow.
63	Naphthol yellow (Grübler).	Yellow.	Decolorized and cloudy.	No change.	No change.	Color not restored.	Orange yellow.	Yellow precipitate.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

No.	Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
			Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
64	Martius yellow.	Yellow.	Paler.	No change.	No change.	Color not restored.	Orange yellow.	Straw yellow.
65	Picric acid.	Yellow.	Yellow and crystal precipitate.	Darker.	No change.	Color not restored.	Colorless.	Yellow.
66	Chrysamin.	Yellow.	Paler and orange precipitate.	Red orange.	Orange.	Color not restored.	Crimson.	Darker, then colorless solution and brown precipitate.
67	Fast yellow (Bad.).	Yellow.	Orange.	No change.	No change.	Color not restored.	Orange.	Orange red.
68	Wool yellow T (Sch.).	Yellow.	No change.	No change.	No change.	Color not restored.	Yellow.	Yellow.
69	Tartrazin (Bad.).	Yellow.	No change.	No change.	No change.	Color not restored.	Yellow.	Yellow.
70	Metanil yellow (Oehler).	Yellow.	Magenta.	No change.	No change.	Color not restored.	Purple.	Magenta.
71	Brilliant yellow S (Sch.).	Yellow.	Darker; more HCl = orange red; more HCl = magenta.	No change.	No change.	Color not restored.	Crimson or magenta.	Magenta, then orange red, orange and yellow.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

No.	Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
			Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
72	Chinolin yellow (R. H.).	Yellow.	No change.	No change.	No change.	Color not restored.	Orange.	Paler to yellow.
73	Chrysoïdin.	Yellow.	Orange.	No change.	No change.	Color not restored.	Brownish yellow.	Red brown, orange brown, and orange.
a74	Sudan I.	Orange yellow.	No change.	Redder.	No change.	.....	Bright red.	Crimson, then orange red precipitate.
a75	Sudan brown (Berlin).	Orange red.	Deep crimson.	Darker.	Darker.	.....	Dark blue.	Violet, and precipitate.
a76	Sudan G.	Orange.	No change.	Brownish red.	Brownish yellow.	.....	Dark reddish brown.	Crimson, then orange and turbid.
77	Malachite-green (Berlin).	Blue.	Orange.	Decolorized.	Decolorized.	Color not restored.	Yellow.	Red-orange, then orange.
78	Ethyl green (Berlin).	Green.	Olive-green. Orange-yellow on adding a little more HCl.	Decolorized by large excess.	Decolorized by large excess.	Color not restored.	Yellow.	Red-orange, then orange.
a78½	Sudan III (prepared by author).	Red orange.	No change.	Purple.	No change.	Color not restored.	Greenish blue.	Violet or purple, then orange-red precipitate.
79	Acid green 780 (Cassella).	Green.	Olive-green; more HCl = orange.	Decolorized by large excess.	Decolorized by large excess.	Color not restored.	Orange-yellow.	Red-orange, then orange.

a Tests made on alcoholic solution of color; color insoluble in water.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

No.	Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
			Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
80	Acid green OO (Sch.).	Blue-green.	Yellowish-green to greenish-yellow.	Partly decolorized.	Partly decolorized.	Color not restored.	Orange-yellow.	Paler.
81	Cyanole green 6 G (Cassella).	Blue-green.	Olive-green; more HCl=orange.	Dark blue.	Dark blue.	Color not restored.	Olive-green.	Orange.
82	Naphthol green B (Cassella).	Green.	Paler.	No change.	No change.	Color not restored.	Orange.	Yellow.
83	Azo blue (By.).	Purple.	Dark precipitate; purple solution.	Pale magenta.	In large excess gradually turns pale magenta.	Color not restored.	Deep blue.	Violet precipitate.
84	Cyanole FF (Cassella).	Purplish-blue.	Greenish-yellow.	Bluish-green by transmitted light; pink by reflected.	No change.	Color not restored.	Yellow.	Orange-yellow.
85	Methylene blue (Bad.).	Blue.	No change.	No change.	No change.	Color restored.	Dark green.	Blue.
86	Tetracyanole SF (Cassella).	Blue.	Yellow.	No change.	No change.	Color not restored.	Yellow.	Orange.
87	Methyl violet DB (Sch.).	Violet.	Yellow.	Magenta.	No change.	Color not restored.	Yellow-orange.	Brown-orange, then green, then blue.
88	Methylene violet 2 BX (Berlin).	Violet.	Greenish-blue; more HCl=yellow-green.	Gradually turns pink.	Gradually grows paler.	Color not restored.	Yellow-orange.	Yellow; copious dilution=pale green and then blue.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

No.	Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
			Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
89	Indigo disulpho acid.	Deep blue.	No change.	Green; more NaOH = yellow.	No change; large excess, NH_4OH = green.	Color restored.	Dark violet blue.	Blue.
90	Bismarck brown (Berlin).	Yellow.	Orange.	No change.	No change.	Color restored.	Brown.	Brownish-red, then orange.
91	Fast brown G (Berlin).	Brownish-red.	Paler solution and violet precipitate.	Magenta.	Magenta.	Color not restored.	Violet-blue.	Magenta.
92	Naphthol black BDF (Cassella).	Deep magenta.	Blue.	Purplish-blue.	Darker.	Color not restored.	Greenish-black.	Green, then blue.
93	Naphthol blue-black (Cassella).	Deep blue.	Blue solution and precipitate.	No change.	No change.	Color restored.	Dark green.	Blue-green, then blue.
94	Cochineal.	Orange red.	Orange yellow.	Magenta.	Magenta.	Zinc dust and HCl = orange yellow. Color not restored.	Pink.	Yellowish pink, then straw yellow.
95	Cudbear.	Lilac.	Yellowish pink.	Purple.	Purple.	Color restored.	Purple.	Red brown.
96	Archil.	Deep lilac.	Yellowish pink.	Purple.	Purple.	Color restored.	Purple.	Red, red brown, and red orange.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concencentrated sulphuric acid*—Continued.

No.	Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
			Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
97	Litmus.	Blue.	Pink.	No change.	No change.	.....	Purple.	Orange red, then pink.
98	Azo litmin.	Dark crimson.	Orange red.	Purple.	Purple.	.....	Purple.	Orange red, then pink.
101	Logwood.	Brownish yellow.	Orange.	Dark brown.	Light brown.	Color not restored.	Yellow brown.	Paler.
102	Brazil wood.	Red orange, slight fluorescence.	Orange, not fluorescent.	Crimson.	Crimson.	Color restored.	Brown yellow, fluorescent.	Yellow, not fluorescent.
103	Barwood.	Insoluble.	Color precipitated on acidifying alkaline solution.	NaOH solution= deep brown red.	Ammonia solution = deep brown red.	NaOH solution + Zn dust=decolorized; on exposure = pinkish, then colorless.	Orange brown.	Pink.
104	Catechu (E and A).	Yellow brown.	Paler, cloudy.	Dark orange brown.	No change.	.....	Brownish red.	Paler.
106	Spanish saffron.	Yellow.	No change.	Paler.	No change.	Color not restored.	Blue, then purple, maroon, and red-brown.	Yellow, then nearly colorless.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

No.	Name of color.	Color of aqueous solution as observed in ¼" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
			Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
108	Quercitron.	Brownish-yellow.	Slightly redder.	Orange-brown.	Orange-brown.	Not decolorized.	Yellow.	Yellow.
109	Sumac.	Dirty yellow.	No change.	Greenish-brown.	Yellow-brown.	NaOH solution + Zn dust = decolorized; on exposure = pinkish, then colorless.	Yellow.	Yellow.
110	Annatto.	Yellow in alkaline solution.	Paler.	.....	.....	Zn + NaOH, not decolorized.	Blue.	Mauve.
111	Turmeric.	Yellow in alkaline solution.	Paler.	.....	.....	Zn + NaOH, not decolorized.	Orange.	Dirty yellow.
112	Persian berry extract.	Yellow.	No change.	Orange.	Deeper.	Not decolorized.	Yellow.	Yellow.
113	Fustic extract.	Yellow.	No change.	Brown-orange.	Orange.	Not decolorized.	Yellow.	Yellow.
114	Weld extract.	Yellow.	Paler.	Deeper.	Deeper.	Not decolorized.	Yellow.	Yellow.
116	Buckthorn.	Yellow.	No change.	Red-brown.	Yellow-brown.	Not decolorized.	Yellow.	Yellow.
116½	Kamala.	Yellow.	Paler and cloudy.	Yellow-brown.	Brownish-yellow.	NaOH solution of color = red; + zinc dust = orange. Original color not restored.	Orange.	Nearly colorless solution and orange precipitate.
122	Pokeberry.	Crimson.	Magenta.	Orange-yellow.	Magenta turning orange brown.	Color not restored.	Orange brown.	Brown.

NOTES ON THE ANALYTICAL SCHEME.

In the preparation of the analytical scheme, the strength of aqueous solutions of coloring matters is approximately 0.01 per cent in the case of coal-tar colors and 0.1 per cent in the case of natural coloring matters.

The following reagents are used and of the strength described, unless otherwise specified:

Tannin reagent. As recommended by Weingartner, 10 grams each of tannic acid and sodium acetate in 100 cc of water.

Hydrochloric acid. Mix equal volumes of concentrated acid and water.

Sodium hydrate solution. Ten grams in 100 cc of water.

Ammonia solution. Approximately 10 per cent NH_3 in water.

Lead subacetate solution. Specific gravity 1.25. (See Chemistry Bulletin 107, p. 40.)

Normal lead acetate solution. Ten grams in 100 cc of water.

Reactions in aqueous or alcoholic solution are carried out by adding to 10 cc of color solution 5 to 10 drops of reagent.

Unless otherwise noted, each test is to be made on a part of the original color solution and not on the solution used for the previous test.

To determine whether a large amount or almost no color is extracted by immiscible solvents is not always very easy by simple inspection, and it is then best to separate the immiscible solvent from the aqueous layer, filter the former, and evaporate it on the water bath with the addition of water if necessary, as in the case of amyl alcohol. Take up the color in water, make slightly acid or alkaline, according to whether the aqueous layer was acid or alkaline, and compare with the latter. Any considerable amount of color will then be more readily evident, and the dye could also be fixed on wool, which it should color strongly.

If the solution is decolorized by acid or alkali when shaking with an immiscible solvent, it is necessary to separate the two layers carefully and neutralize both in order to find the relative proportion of color in each layer.

In all cases it is advisable, after using the analytical scheme for the identification of a color, to confirm its identity further by applying the appropriate tests as given in Tables I to IV. Many special tests for certain colors will also be found in Allen, loc. cit.; Girard, Analyse des matières alimentaires, etc.; Circular 25 and Bulletin 107, Revised, Bureau of Chemistry; and other works.

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ANALYTICAL SCHEME FOR THE PRELIMINARY IDENTIFICATION OF COLORS IN FOODS.

(Confirm by tests given in Tables I to IV.)

I. GREEN COAL-TAR COLORS.

[Mixed blue and yellow generally detected by spot test on filter paper or by fractional dyeing.]

I. To aqueous 0.01 per cent solution of color add tannin reagent.

A. No precipitate. Add 10 per cent NaOH solution to aqueous color solution.

a. Gradually decolorized ..... *Acid green* (S. & J. 435)

b. Dark blue ..... *Cyanole green 6 G*

c. No change ..... *Naphthol green B* (S. & J. 398)

B. Precipitate. Acidify aqueous solution with HCl and extract with equal volume of ethyl acetate.

a. Color all extracted ..... *Ethyl green*

b. About one-half color extracted ..... *Malachite green* (S. & J. 427)

II. BLUE OR VIOLET COLORS.

I. Insoluble in cold water. Treat with 50 per cent alcohol.

A. Insoluble ..... *Indigo* (S. & J. 689)

B. Soluble ..... *Litmus*

II. Soluble in cold water. Add tannin reagent to 0.01 per cent aqueous solution.

A. No precipitate. Treat with zinc dust +HCl till decolorized, then filter.

a. Color of filtrate quickly restored ..... *Indigo disulpho-acid* (S. & J. 692)

b. Color not soon restored in filtrate. To aqueous solution add NaOH solution.

1. Solution blue green by transmitted light, pink by reflected light ..... *Cyanole F F* (S. & J. 439)
2. No change ..... *Tetracyanole S F* (S. & J. 440)
3. Pale magenta ..... *Azo blue* (S. & J. 287)

B. Precipitate. Aqueous solution +10 per cent NaOH.

a. Solution magenta.

1. Aqueous solution +HCl = yellow ..... *Methyl violet* (S. & J. 451)
2. Aqueous solution +HCl = green ..... *Methylene violet* (S. & J. 585)

b. Solution; no change ..... *Methylene blue* (S. & J. 650)

I. **Soluble in cold water.** To aqueous solution add tannin reagent.

A. No precipitate. Apply double-dyeing test to aqueous color solution.

a. Wool dyed. To aqueous solution add dilute HCl.

1. Solution changes from yellow to orange ..... *Fast yellow* (S. & J. **8**)
2. Pale yellow or white precipitate. Boil aqueous solution with strong solution of KCN.
   - α. Yellow brown solution ..... *Naphthol yellow* (S. & J. 3)
   - β. Wine-red solution. To aqueous solution add dilute HCl, allow to stand one-half hour, and filter.
     - Filtrate colorless ..... *Victoria yellow* (S. & J. 2)
     - Filtrate yellow ..... *Picric acid* (S. & J. 1)
3. Solution almost or quite decolorized. Aqueous solution acidified slightly with HCl and shaken with equal volume of ether; two layers separated and ether layer washed twice with 5 to 10 cc water; to ether layer is added an equal volume of very dilute NH_4OH; shake and allow to separate.
   - α. Aqueous layer bright yellow ..... *Naphthol yellow* (S. & J. 3)
   - β. Aqueous layer uncolored ..... *Naphthol yellow S* (S. & J. 4)
4. Orange brown precipitate ..... *Chrysamine* (S. & J. 220 or 269)
5. No change. To aqueous solution add NaOH solution.
   - α. Solution remains yellow. Treat dry color with acetic ether.
     - 1a. Color insoluble ..... *Tartrazine* (S. & J. 94)
     - 2a. Color quite soluble ..... *Quinoline yellow* (S. & J. 667?)
   - β. Solution becomes redder. Treat dry color with concentrated H_2SO_4.
     - 1a. Crimson or magenta solution ..... *Orange II* (S. & J. 86)
     - 2a. Orange solution. To aqueous solution add 10 per cent $BaCl_2$ solution and allow to stand a minute.
       - 1b. Orange precipitate ..... *Ponceau 4 GB* (S. & J. 13)
       - 2b. No *colored* precipitate (possibly a precipitate of $BaSO_4$ insoluble in HCl).
         - Dry color brown orange. Aqueous solution + 10 per cent lead subacetate solution; solution turns orange red and orange red precipitate slowly forms ..... *Tropæolin O* (S. & J. 84)
         - Dry color bright red. Aqueous solution + 10 per cent lead subacetate; no change or slight turbidity only ..... *Orange G* (S. & J. 14)

6. Crimson or red. To aqueous solution add NaOH solution.
   - α. No change in color; pale glistening precipitate. Dry color + concentrated H_2SO_4.
     - Purple or violet solution ..... *Orange IV* (S. & J. 88)
     - Brown solution ..... *Orange III* (S. & J. 87)
   - β. Much redder ..... *Orange I* (S. & J. 85)
   - γ. Little or no change and no precipitate. Dry color + concentrated H_2SO_4.
     1. Brown solution ..... *Orange III* (S. & J. 87)
     2. Crimson or magenta solution ..... *Brilliant yellow S* (S. & J. 89)
     3. Purple or violet solution. To 10 cc aqueous solution add about 20 drops NaOH solution.
        - α Colorless glistening precipitate at once or on standing a few minutes ..... *Orange IV* (S. & J. 88)
        - β No change ..... *Metanil yellow* (S. & J. 95)

b. Wool not dyed. To aqueous solution add dilute NH_4OH.

1. No change. Dry color + concentrated H_2SO_4 = blue or greenish blue ..... *Saffron*
2. Darker. Shake aqueous solution with equal volume of acetic ether.
   - α. No color extracted. Aqueous solution + 10 per cent $FeCl_3$ solution, yellow brown solution, no precipitate ..... *Weld* (S. & J. 696)
   - β. Considerable color extracted by acetic ether. To aqueous solution add 10 per cent solution normal lead acetate.
     1. Solution turns bright yellow, no precipitate ..... *Buckthorn* (S. & J. 700)
     2. Brownish precipitate. Add to aqueous solution 10 per cent alum solution.
        - α. Solution yellow; no precipitate ..... *Quercitron* (S. & J. 699)
        - β. Turbidity which is cleared up by a few drops of acetic acid and solution then has decided green fluorescence ..... *Fustic* (S. & J. 698)

B. Colored precipitate. To color solution add NaOH solution.

a. Solution decolorized and white precipitate of base. On shaking alkaline solution with ether, solution becomes clear and ether layer turns yellow on adding drop of acetic acid ..... *Auramine* (S. & J. 425 or 426)

b. Yellow or orange precipitate. On shaking alkaline solution with ether, solution becomes clear and color passes mostly into ether layer, which is orange yellow ..... *Chrysoidine* (S. & J. 18?)

c. No change ..... *Thioflavine*

III. ORANGE AND YELLOW COLORS—Continued.

II. **Insoluble in cold water.** Treat with 95 per cent alcohol.

A. SOLUBLE. To alcoholic solution add HCl.

1. Crimson or pink ..... *Butter yellow* (S. & J. 16)
2. No change or paler. Treat alcoholic solution with zinc dust and a few drops of acetic acid and shake for about half a minute and filter.

α. Filtrate colorless. Dry color and concentrated H_2SO_4.

Reddish brown ..... *Sudan G* (S. & J. 10)
Bright red ..... *Sudan I* (S. & J. 11)

β. Not decolorized or only partially so. (Distinguish and identify by usual tests.) ..... *Turmeric or Annatto*

B. INSOLUBLE. Treat with boiling water.

Soluble ..... *Catechu* (S. & J. 703)
Insoluble ..... *Color lakes*

(Identify metallic base by qualitative analysis of ash. Identify coloring matter by dissolving lake in acid and extracting with immiscible solvent or by fixing on fiber.)

IV. RED COLORS.

I. Soluble in cold water.

A. DILUTE AQUEOUS SOLUTION FLUORESCENT. Apply double dyeing test of Sostegni and Carpentieri (Bureau of Chemistry Bul. 107, revised, p. 190).

a. Fiber not dyed ..... *Brazil wood* (S. & J. 701)
b. Fiber dyed. Add to aqueous solution a few drops tannin reagent.

1. Colored precipitate ..... *Rhodamine* (S. & J. 504)
2. No precipitate. Prepare a dilute solution of color in 95 per cent alcohol.

α. Solution has green fluorescence ..... *Eosin A* (S. & J. 512)
β. Solution has yellow or orange fluorescence ..... *Phloxine* (S. & J. 518 or 521)

B. DILUTE AQUEOUS SOLUTION NOT FLUORESCENT. Add to solution of color a few drops of tannin reagent.

a. No precipitate of color. Apply double dyeing test of Sostegni and Carpentieri (Bul. 107, revised, p. 190). [If, in course of test, fiber or solution becomes purple on addition of NH_4OH, test directly for *cochineal* by Robin's tests (Bul. 107, revised, p. 200) or *lichen colors* by Tolman's method (J. Amer. Chem. Soc., 1905, p. 213).]

1. Fiber dyed. Make 0.01 per cent aqueous solution alkaline with NH_4OH and extract with amyl alcohol.

α. Considerable color extracted by amyl alcohol, which is colored red. Shake color solution, acidified with HCl, with ether.

x. Considerable color passes into ether layer.

1*a*. Aqueous layer colorless; ether layer yellow ..... { *Erythrosin* (S. & J. 517) / *Rose Bengal* (S. & J. 520 or 523)

[Rose Bengal solution is pink; erythrosin is red orange. Can only be distinguished with certainty by testing for or determining both chlorin and iodin in the color, carefully purified by extraction with ether from acidified solution.]

2*a*. Aqueous layer remains red; ether layer orange or red. To aqueous solution add ammonia.

Brownish-yellow solution ..... *Azo eosin* (S. & J. 71)

No change.

Aqueous solution of color orange red; +HCl, yellow-brown precipitate. *Fast red A* (S. & J. 102)

y. Color not extracted by ether. Make solution alkaline with NH_4OH and shake again.

1*a*. Color passes into ether layer, which is colorless ..... *Magenta* (S. & J. 448)

2*a*. Color does not dissolve in ether layer. Extract acid solution with acetic ether.

1*b*. Considerable color extracted. Treat dyed fiber with concentrated HCl.

1*c*. Fiber colored crimson. Dissolve in neutral amyl alcohol.

Fluorescent ..... *Azo eosin* (S. & J. 71)

Not fluorescent ..... { *Archil substitute 3VN* (S. & J. 29) / *Archil substitute* (S. & J. 28)

2*c*. Fiber colored yellowish. Dissolve in neutral acetic ether.

Not fluorescent ..... *Erythrosin*

Fluorescent ..... *Rose Bengal* (S. & J. 520 and 523)

2*b*. No color extracted. Treat dyed fiber with concentrated HCl.

1*c*. Fiber colored blue. To dyed fiber add NaOH solution.

1*d*. Fiber crimson. To 10 cc aqueous solution add 5 drops HCl.

No change ..... *Ponceau 4RB* (S. & J. 160)

Dark blue and precipitate ..... *Benzopurpurine* (S. & J. 277 or 278)

2*d*. Fiber brown or brown violet. To dyed fiber add concentrated H_2SO_4 = green, *Fast Ponceau B* (S. & J. 163)

2*c*. Fiber colored magenta ..... *Fast red B* (S. & J. 65)

I. **Soluble in cold water**—Continued.

B. Dilute aqueous solution not fluorescent—Continued.

a. No precipitate of color—Continued.

1. Fiber dyed—Continued.

β. Almost no color extracted. Treat dyed fiber with concentrated HCl.

1*a*. Crimson or scarlet. To dry color add concentrated H_2SO_4.

1*b*. Purple or violet. Acidify aqueous color solution with HCL and shake with amyl alcohol.

1*c*. No color extracted. To aqueous solution add NaOH solution.

Dirty yellow solution—Dry color is yellow-brown ..... *Ponceau 6R* (S. & J. 108)

Darker red solution—Dry color is brownish-red ..... *Amaranth* (S. & J. 107)

2*c*. Much color extracted—Amyl alcohol layer scarlet ..... *Fast red C* (S. & J. 103)

2*b*. Crimson or scarlet. Note color of neutral aqueous solution (0.01 per cent).

1*c*. Orange red. To 0.01 per cent aqueous solution add 10 per cent $BaCl_2$ solution.

1*d*. Crimson precipitate. To aqueous solution add 10 per cent $FeCl_3$ solution.

Orange precipitate ..... *Ponceau 3R* (S. & J. 56)

No precipitate ..... *Ponceau 2R* (S. & J. 55)

2*d*. No precipitate. Saturate aqueous solution with salt and extract with equal volume of neutral acetone.

Acetone extracts almost no color ..... *Cochineal red A* (S. & J. 106)

Acetone layer extracts considerable color and is orange, *Brilliant cochineal 2R* (S. & J. 53)

2*c*. Crimson or magenta ..... *Lanafuchsine*

2*a*. Nearly or quite decolorized ..... *Acid magenta* (S. & J. 462)

(See also Girard's and Bellier's tests, Bul. 107, revised, p. 193, and Girard and Dupré, Analyse des matières alimentaires, p. 169.)

3*a*. Purple ..... *Fast red B* (S. & J. 65)

4*a*. Blue. To dry color add concentrated H_2SO_4.

1*b*. Magenta solution ..... *Biebrich brilliant crocein scarlet* (S. & J. 146)

2*b*. Blue solution. To dyed fiber add NaOH solution.

1*c*. Fiber purple ..... *Biebrich fast scarlet* (S. & J. 159)

2c. Fiber brown. To aqueous solution add lead subacetate solution.
1d. Yellow solution; orange precipitate ..... *Crocein scarlet 3B* (S. & J. 160)
2d. Pink solution; red precipitate ..... *Crocein scarlet 7B* (S. & J. 169)

2. Fiber not dyed. Dye wool, mordanted with alum, in aqueous color solution.
α. Wool colored bluish or grayish violet ..... *Logwood* (S. & J. 702)
β. Wool colored bright red ..... *Brazil wood* (S. & J. 701)

b. Colored precipitate. Dissolve color in ethyl or amyl alcohol and also in acetone.
1. Solutions fluorescent. To dyed fiber add 10 per cent NaOH solution = crimson ..... *Safranine* (S. & J. 584)
2. Solutions not fluorescent. To dyed fiber add 10 per cent NaOH solution = decolorized ..... *Magenta* (S. & J. 448)

II. Insoluble in cold water.

A. To alcoholic solution add NH_4OH=blue ..... *Alcannin*

B. To dry color add concentrated H_2SO_4.
1. Greenish-blue solution ..... *Sudan III* (S. & J. 143)
2. Crimson solution ..... *Sudan II* (S. & J. 49)
3. Fluorescent brown-yellow solution ..... *Brazil wood* (S. & J. 701)

C. Color dissolves in alkalies, forming orange solution (cotton immersed in alkaline solution is dyed red on acidifying) ..... *Carthamine*

D. Nearly insoluble even in hot water, soluble in dilute alkali with brown-red color; completely precipitated, on acidifying, in red-brown flakes ..... *Barwood or sandalwood* (S. & J. 705)

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